STRUCTURAL ALUMINUM

ALCOA

1930

R. H. TATLOW III
638 WOODWARD BLDG. DI. 1672
WASHINGTON, D. C.

Jan 29-1931

NOTICE

This handbook indicates the range of sizes which our mills are capable of producing. However, rolls and die equipment are not on hand for all sizes, but will be added to the equipment from time to time as the demand may warrant.

The Company maintains a stock of structural shapes representative of its current roll and die equipment. It is recommended, therefore, that the designer always use this book in connection with our current stock lists, which can be obtained upon application to our nearest sales office. These offices are listed for your convenience facing the title page of Part I.

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STRUCTURAL ALUMINUM HANDBOOK

ALUMINUM COMPANY OF AMERICA
PITTSBURGH, PENNSYLVANIA

1930

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PRICE ONE DOLLAR

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FOREWORD

THIS first edition of the Structural Aluminum Handbook is intended to bring to the designer and builder the information needed for using aluminum structurally. In order that this may be truly a handbook, discussions have been made very brief. For a more complete exposition of the production, fabrication, and uses of aluminum, the reader will find other literature of interest.*

In this Handbook it will be noted that the various aluminum structural shapes correspond generally to accepted steel standards. The elements of sections (areas, moments of inertia, radii of gyration, etc.) will be found to differ slightly from corresponding values given for steel shapes in some cases, because fillets and roundings have been included in the computations for the aluminum shapes.

Credit is due the current handbooks on similar subjects which were consulted from time to time during the preparation of this book as to arrangement and presentation of data. Any suggestions for the improvement of later editions of this Handbook will be gratefully received.

Aluminum Company of America issues Stock Lists at frequent intervals giving the latest information as to the shapes and sizes available. These should be used with this Handbook.

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*"*The Aluminum Industry*"—Edwards, Frary, and Jeffries. (McGraw-Hill Book Co. 1930). Also the following Aluminum Company of America booklets:

"*Strong Aluminum Alloys*"
"*Machining Aluminum*"
"*Aluminum Casting Alloys*"
"*The Riveting of Aluminum*"
"*The Welding of Aluminum*"
"*Screw Machine Products*"

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PRODUCTS

OF ALUMINUM COMPANY OF AMERICA

Alcoa Ingot, Billets, and Slabs. Alcoa Casting Alloy Ingot.
Alcoa Metallurgical Granulated Ingot.
Structural Beams, Channels, Angles, Tees, and Zees. Car Channels.
Bars: Round, Square, Rectangular, and Hexagonal.
Sheared and Sawed Plates, Rectangular and Circular.
Tank Plates.
Flat and Coiled Sheet, and Circles. Corrugated Sheets.
Tubing, Pipe, Handrails, and Rigid Conduit.
Aircraft Streamline Tubing.
Pipe, Conduit, and Handrail Fittings.
Extruded Shapes and Moldings.
Aircraft, Architectural, Car Building, and Bus Body Sections.
Castings: Sand, Die, and Permanent Mold.
Drop Forgings.
Lynite Pistons and Connecting Rods.
Rivets, Bolts, Nuts, Nails, and Screw Machine Products.
Wire: Round, Half Round, Oval, and Flattened.
Aluminum Cable Steel Reinforced, Cable Fittings.
All Aluminum Cable, Aluminum Bus Bar.
Welding and Soldering Flux and Wire.
Furniture.
Chemical Apparatus, Draw Press Products.
Albron Bronze Powder and Albron Lithograph Powder.
Aluminum Shingles, Flashings, Gutters, and Downspouts.
Collapsible Tubes.
Aluminum Foil: Plain, Printed, Embossed, and Lacquered.
Bottle Closures and Sealing Machines.
Aluminum Oxide, Aluminum Hydrate, Activated Alumina, Bauxite.
Aluminum Fluoride, Fluorspar, Sodium Fluoride, Miscellaneous Fluorides.
Lime (Quick and Hydrated) and Plaster (Calcined).

INSTRUCTIONS

FOR ORDERING MATERIAL

THE following information is given to acquaint the user with the preferred method of specifying aluminum materials. The actual ordering may be accomplished through the Company's nearest sales office.

The manner of specifying aluminum materials is in general similar to that of specifying other metals. The following points are enumerated to emphasize the essential parts of every order:

QUANTITY. Quantity may be stated in number of pieces, pounds, or feet.

SIZE. Size should be so stated as to identify clearly the piece ordered. Structural shapes should be specified as indicated on pages 43 through 68. Sheet thickness should be specified in decimals of an inch or in B&S gage. Tubing may be specified by iron pipe size or by wall thickness and outside diameter, wall thickness being stated either in decimals of an inch or in Stubs gage.

ALLOY and TEMPER. *Alloy and temper must always be stated.* The sections entitled "The Manufacture of Aluminum Alloys" and "The Structural Use of Various Alloys" will assist the user in choosing the proper alloy.

EXAMPLES

Shapes: 500 pcs. 6 in. x 0.314 in. web x 60 ft.-0 in. ..... 25ST Channel

Sheet: 1000 pcs. 0.125 in. x 24 in. x 72 in. ..... 17ST Flat Sheet
20,000 lb. No. 14 ga. x 12 in. ..... 3SO Coiled Sheet

Tubing: 600 pcs. 3 in. I.P.S. x 16 ft.-0 in. ..... 3S½H Tubing
400 pcs. No. 12 ga. x 2¾ in. O.D. x 12 ft.-6 in. ..... 51ST Tubing

Wire: 10,000 lb. No. 16 ga. ..... 3SH Coiled Wire

SALES OFFICES

OF ALUMINUM COMPANY OF AMERICA

Albany, N. Y.	90 State Street
Atlanta, Ga.	1818 Rhodes-Haverty Building
Boston, Mass.	Statler Building
Buffalo, N. Y.	1880 Elmwood Avenue
Chicago, Ill.	360 North Michigan Boulevard
Cincinnati, Ohio	903 Dixie Terminal Building
Cleveland, Ohio	910 Hanna Building
Detroit, Mich.	3311 Dunn Road
Indianapolis, Ind.	714 Merchants National Bank Building
Kansas City, Mo.	804 Land Bank Building
Los Angeles, Calif.	1031 South Broadway
Milwaukee, Wis.	425 East Water Street
Newark, N. J.	17 Academy Street
New York, N. Y.	230 Park Avenue
Philadelphia, Pa.	Fidelity-Philadelphia Trust Building
Pittsburgh, Pa.	2400 Oliver Building
San Francisco, Calif.	709 Rialto Building
St. Louis, Mo.	1825-1833 Boatmen's Bank Building
Toledo, Ohio	825 Nicholas Building
Washington, D. C.	606-610 Southern Building

STRUCTURAL ALUMINUM HANDBOOK

PART I

Structural Aluminum

THE MANUFACTURE OF ALUMINUM ALLOYS

THE element, aluminum, was first isolated in 1825 by H. C. Oersted, the Danish scientist. In 1886, Charles M. Hall in this country and P. L. T. Héroult in France, working independently, discovered practical electrolytic processes for obtaining aluminum. The industrial development of aluminum in America began shortly after Mr. Hall's invention.

Aluminum forms a part of most clays, soils, and rocks; but the principal commercial source is the ore, bauxite. Bauxite is largely hydrated aluminum oxide mixed with impurities such as compounds of iron and silicon. These impurities are removed by a chemical process leaving the pure aluminum oxide, alumina. By means of an electrolytic process, alumina is reduced to metallic aluminum which is cast into pig form. The pigs are later remelted to form the commercial ingots used in rolling, extruding, and other fabricating processes.

In order to increase the mechanical properties or otherwise alter the characteristics of aluminum, it is often alloyed with various other elements when making the ingots. There are many alloys used, each having characteristics suitable to certain types of work. Table 1 gives the nominal compositions of the seven alloys in widest use for structural work.

TABLE 1

APPROXIMATE COMPOSITION OF ALUMINUM ALLOYS MOST FREQUENTLY USED STRUCTURALLY

Alloy		Per cent of other elements added to aluminum			
		Copper	Manganese	Magnesium	Silicon
Wrought	3S		1.25		
	17S	4.0	0.5	0.5	
	25S	4.5	0.8		0.8
	51S			0.6	1.0
Cast	12	8.0			
	43				5.0
	195-4	4.0			

The mechanical properties of 3S alloy depend upon the temper of the metal which is determined by the amount of strain hardening or cold working given the metal during fabrication. 3S is ordinarily produced in the following tempers: annealed, quarter hard, half hard, three quarter hard, and hard. These are designated 3SO, 3S ¼H, 3S ½H, 3S ¾H, and 3SH. 3S can be annealed at a temperature of 800°F.

Alloys 17S, 25S, and 51S are known as the Strong Alloys. Their maximum mechanical properties are produced by heat-treatment followed by proper aging, and when they have been so treated they are designated 17ST, 25ST, and 51ST. In 17S alloy the aging takes place spontaneously at room temperatures following heat-treatment, and hence this alloy cannot be kept in the unaged or W condition. 25S and 51S, however, are aged artificially at a higher temperature and hence may be produced in the heat-treated condition without being aged. In this condition they are designated as 25SW and 51SW, their properties being somewhat lower than in the fully-aged or T condition. The strong alloys can be annealed after heat-treatment by holding them at a temperature of 800°F. for at least one hour, after which they should be very slowly cooled to below 500°F. In the annealed condition the strong alloys are designated 17SO, 25SO, and 51SO.

The casting alloys are designated by numbers only, as indicated in Table 1, and are referred to as No. 12 alloy, No. 43 alloy, and No. 195-4 alloy. No. 195-4 alloy differs from the other two in that it is heat-treated to improve its mechanical properties. The heat-treatment used is indicated in Table 2.

TABLE 2

DATA ON HEAT-TREATMENT OF ALLOYS
All Temperatures in Degrees Fahrenheit

	Alloy	Heat-Treating Temperature	Approximate Time of Heating*	Quench**	Aging Temperature	Time of Aging
Wrought	17S	940 to 960	15 to 60 min.	Cold water	Room	4 days†
	25S	960 to 980	15 to 60 min.	Cold water	285 to 295	8 to 15 hrs.
	51S	960 to 980	15 to 60 min.	Cold water	310 to 320	18 hrs.
Cast	195-4	960	12 hours	Hot water	.....	.....

*Depends on size and amount of material.
**It is essential that the quench be made with a minimum time loss in transfer from the furnace.
†More than 90 per cent of the maximum properties are obtained during the first day of aging.

Attention is called to the fact that the seven alloys named in Table 1 are not the only ones made. Many other alloys are produced commercially and experimentally but do not come within the scope of this book.

THE MECHANICAL PROPERTIES OF ALUMINUM ALLOYS

A SYSTEM of routine testing provides a careful check on the mechanical properties of the various aluminum alloys at all times. This testing is carried on in laboratories located in the various plants, under the supervision of a central organization in the Research Laboratories of the Company. All tests are standardized and all equipment is calibrated regularly to insure a high degree of accuracy in the results. The data are filed in such a manner that a record is available showing the properties of the materials produced at each plant.

The routine tests usually include determinations of tensile strength, yield point, and elongation. Compressive strength, shear strength, endurance limit, and other me-

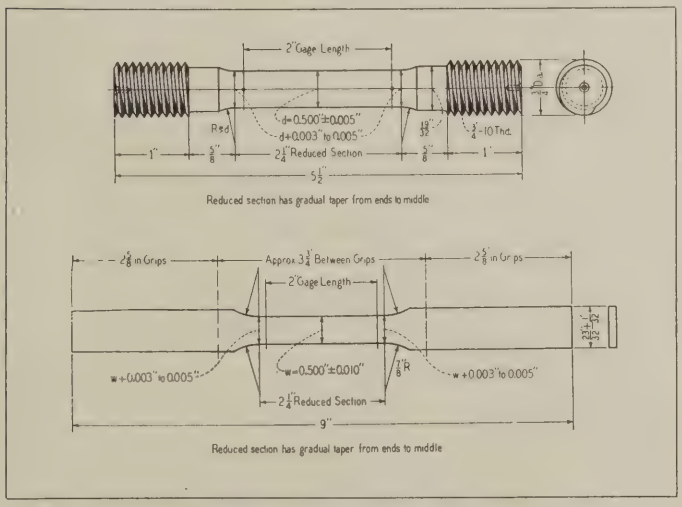


FIGURE 1—TENSILE SPECIMENS

TABLE 3

TYPICAL MECHANICAL PROPERTIES OF ALUMINUM ALLOYS

	Alloy and Temper	Weight lb. per cu. ft.	TENSION			COMPRESSION		Shearing Strength lb. per sq. in.	Endurance†† Limit lb. per sq. in. (Rotating Beam)	Brinell Hardness No. (500 kg. on 10mm. ball)
			Yield** Point lb. per sq. in.	Ultimate** Strength lb. per sq. in.	Elongation** in 2 In. per cent	Yield Point lb. per sq. in.	Ultimate Strength lb. per sq. in.			
Wrought	3SO	171	5000	16000	40	5000	16000	11000	6000	28
	3S½H	171	18000	21000	20	18000	21000	14000	9500	45
	3SH	171	25000	29000	10	25000	29000	16000	10500	55
	17ST	174	35000	58000	20	35000	58000	35000	15000	100
	25SW	174	25000	48000	18	25000	48000	30000	14500	80
	25ST	174	35000	58000	20	35000	58000	35000	15000	100
	51SW	168	20000	35000	24	20000	35000	24000	10500	64
	51ST	168	35000	48000	14	35000	48000	30000	10500	95
†Cast	12	178	14000	22000	2	16000	38000	20000	8500	65
	43	166	9000	19000	4	9000	25000	15000	6500	40
	195-4	174	16000*	31000	8	27000	43000	27000	6000	65

*Natural aging will gradually increase the yield point to 20,000 lb. per sq. in. or more. This requires from 3 to 6 months.
†Values obtained on sand cast specimens.
**For specification values consult nearest sales office of the Company.
††Based on the material withstanding 500 million cycles of stress.

chanical properties are determined largely by the Research Laboratories of the Company. All values are determined on a sufficient number of samples to be representative of the properties of the commercial product.

The mechanical properties are determined by methods which the American Society for Testing Materials has approved or by other generally accepted methods. The yield point is taken as the stress at which the stress-strain curve shows a departure of 0.002 units of strain from the initial modulus line produced. In fatigue tests the endurance limit is predicated on the material withstanding five hundred million cycles of stress.

Table 3 shows typical values for the mechanical properties of the various aluminum alloys. These have been used as a basis for selecting the design stresses in Table 4.

THE DESIGN OF ALUMINUM ALLOY STRUCTURES

THE design of aluminum structures differs very little from the practice with steel and other metals. This fact makes it unnecessary to go into great detail in this discussion, but it will be helpful if certain phases of the subject are treated briefly.

In structural design it is common practice to compute, on the basis of the principles and assumptions of mechanics, the stresses to which the various parts of a structure will probably be subjected during its life. In general, when these computed stresses do not exceed certain values known as design stresses, the structure is considered safe. The design stresses, then, become the criterion for proportioning the size and shape of most of the parts of a structure.

The design stresses for any structure must obviously be less than the strength of the material as indicated in its mechanical properties, by a considerable margin. How much this margin of safety shall be depends upon a number of factors and often the designer must rely on his own judgment in his selection. The following paragraphs point out the manner of selecting the design stresses given in Table 4.

TENSION

For simple axial tension and for tension on the extreme fibers in bending, a design stress of one-fourth the ultimate strength is recommended. In cases where the yield point exceeds one-half the ultimate tensile strength, a design stress higher than one-fourth the ultimate strength is sometimes justified. In these cases, it is recommended that the value used does not exceed either one-half the yield point or one-third the ultimate tensile strength. Where an alloy is subjected to a large number of cycles of repeated stress, the de-

TABLE 4

DESIGN STRESSES FOR ALUMINUM ALLOYS

Values below are considered safe for ordinary structural design. When temperatures above 100°F. are to be encountered, multiply these values by factors in Table 5.

	Alloy and Temper	Tension lb. per sq. in.	Compression† lb. per sq. in.	Bearing lb. per sq. in.	Shear lb. per sq. in.	Fatigue lb. per sq. in.
Wrought	3SO	4000	4000	4000	3000	4800
	3S½H	6000	6000	7000	3500	7600
	3SH	8000	8000	10000	4000	8400
	17ST	15000	15000	19000	9000	12000
	25SW	12000	12000	16000	7500	11600
	25ST	15000	15000	19000	9000	12000
	51SW	9000	9000	11000	6000	8400
	51ST	14000	14000	16000	7500	8400
Cast	12	5000	9000	9000	5000	6800
	43	5000	6000	6000	4000	5200
	195-4	7000*	11000	14000	7000	4800

*Value given is for unaged casting. Where casting is to be aged for 3 to 6 months before use, a design stress of 9000 lb. per sq. in. is safe provided fatigue is not an important item.

†Short stiff members.

TABLE 5

FACTORS FOR DESIGN STRESSES AT ELEVATED TEMPERATURES

	Alloy and Temper	100°F.	200°F.	300°F.	400°F.	500°F.
Wrought	3SO	1	0.80	0.70	0.55	0.40
	3S½H	1	0.65	0.50	0.40	0.30
	3SH	1	0.55	0.45	0.35	0.25
	17ST	1	0.90	0.75	0.30	0.15
	25SW	1	0.90	0.75	0.25	0.15
	25ST	1	0.90	0.75	0.20	0.10
	51SW	1	0.90	0.75	0.20	0.15
	51ST	1	0.90	0.75	0.15	0.10
Cast	12	1	0.90	0.85	0.80	0.70
	43	1	0.80	0.70	0.55	0.40
	195-4	1	1.00	1.00	0.85	0.60

sign stress should not exceed eight-tenths of the endurance limit.

COMPRESSION *(Bearing, bending, and short columns)*

For bearing, a design stress of one-third the ultimate compressive strength is recommended except in the case of annealed material, in which case one-fourth the ultimate compressive strength should be used. For simple axial compression on short stiff members and for compression on the extreme fiber in bending, a design stress of one-fourth the ultimate strength is recommended with the same exception for alloys with high yield points as was made for tension. Values for ultimate strength and yield point in compression are frequently not clearly defined, but it is satisfactory for wrought materials to assume them equal to the tension values. In fact, it is common practice in wrought materials to use the same design stress in tension and compression, even though the ultimate strength and yield point in compression may be slightly higher than in tension. In the case of cast materials, however, the use of a higher design stress in compression than in tension is generally justified.

SHEAR

In designing for shear, a design stress of one-fourth the ultimate shearing stress is recommended.

COMPRESSION *(Long Columns)*

Slender members which are not restrained against sidewise buckling cannot develop high compressive stresses. In such cases, the design stresses should be less than those for short stiff members by an amount which depends on the slenderness of the members.

Tests made on columns of wrought aluminum alloys carrying axial loads have indicated that the general formulas on page 19, when used with values of C, B, and K from Table 6, give safe design stresses and represent quite

closely the true relation of strength to slenderness. The nomenclature is as follows:

f=safe design stress on axially loaded column in lb. per sq. in.
L=unsupported length of column in inches
r=least radius of gyration of column in inches
L/r=slenderness ratio of column

General Formulas for Design Stress on Axially Loaded Columns

Round Ends

For L/r values of 0 to C.....$f = B - K(L/r)$

For L/r values of C and up.....$f = \frac{33{,}000{,}000}{(L/r)^2}$

Fixed Ends

For L/r values of 0 to C.....$f = B - K(L/r)$

For L/r values of C and up.....$f = \frac{132{,}000{,}000}{(L/r)^2}$

TABLE 6

VALUES FOR COLUMN FORMULAS

Alloy and Temper	Round-Ends			Fixed-Ends		
	C	B	K	C	B	K
3S½H	128	6000	31	256	6000	15.5
3SH	111	8000	48	222	8000	24
17ST	81	15000	123	162	15000	61 5
25SW	91	12000	88	182	12000	44
25ST	81	15000	123	162	15000	61 5
51SW	105	9000	57	210	9000	28.5
51ST	84	14000	111	168	14000	55 5

Figure 2 shows the formulas for 17ST and 25ST columns plotted for values of L/r from 0 to 300. It will be noted that the straight-line portion is tangent to the curve portion at L/r = C. The curve portion represents the Euler formula, $f = k \frac{\pi^2 E}{(L/r)^2}$, in which k is a constant that depends on the end conditions and E is the modulus of elasticity of the material. The above is true of the formulas for the other alloys as well as for 17ST and 25ST.

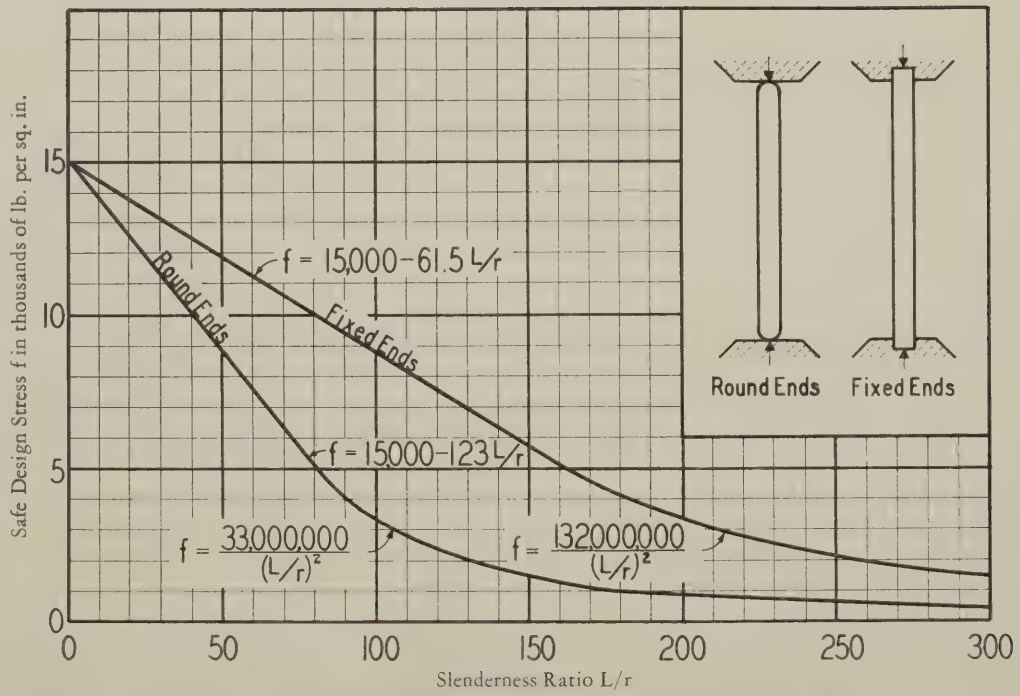


FIGURE 2—SAFE DESIGN STRESSES FOR 17ST AND 25ST COLUMNS

Most structural columns and struts are neither fixed-end nor round-end but fall in between these two extreme conditions, and therefore it is necessary for the designer to decide what the end conditions of a column are before selecting his design stress. The ultimate strength of axially loaded aluminum columns is about three times the design stress given in the formulas on page 19 except in the case of short columns made of very thin material which may prove to be weak locally.

TEMPERATURE

The discussion of design stresses given so far holds good only for temperatures of about 100°F. and below, which cover the range of temperature to which structures are ordinarily subjected. When a structure is to be subjected to temperatures higher than this, certain precautions are necessary. In the first place, the strength of aluminum and its alloys decreases with increasing temperatures, as in the case of other metals. In addition to this, sufficiently elevated temperatures cause an annealing effect which may offset the advantages of harder tempers or heat-treatment and reduce the alloy to its annealed condition. Therefore, the design stresses should be reduced to provide a suitable margin of safety at the highest operating temperature. Table 5 gives factors by which the design stresses at ordinary temperatures should be multiplied to give safe values at elevated temperatures.

The coefficient of expansion of aluminum alloys averages about 0.000013 per degree F. as indicated in Tables 31 and 32 in Part II. The fact that this differs considerably from the coefficient for steel might at first seem to preclude the possibility of using these two metals in contact. A little study, however, will show that the stresses produced by temperature in ordinary cases are not necessarily severe. Aluminum plates have been riveted to the steel sills and side framing in railway cars and have given no trouble even under wide temperature variations. This

demonstrates that where such composite construction is desirable it can be used without difficulty from this source.

IMPACT

Impact stresses are taken into account in design in most cases when moving loads are used. Tests on built-up aluminum frames and steel frames have shown that the impact effects on the former are no more severe than on the latter. It is recommended that steel practice be followed in designing aluminum structures for impact.

WEIGHT

The weights of aluminum alloys average about 173 pounds per cubic foot, which is considerably less than the weights of other commonly used metals, as noted in Table 33. Full advantage of this weight saving should be taken in design where it reduces dead load stresses, inertia stresses, and power required for operation.

DEFORMATION

It is sometimes necessary in design to consider the deformations produced in a structure by stress. In such cases, it is important to realize that the modulus of elasticity of aluminum and its alloys is 10,000,000 pounds per square inch as compared with 29,000,000 pounds per square inch for steel. This means that aluminum will deform about 2.9 times as far under the same stress as steel. Since most formulas used in computing deflections and deformations are expressed in terms of E (modulus of elasticity) they serve as well for aluminum as for steel if the proper value of E is used. A comparison of the moduli of elasticity for various materials may be found in Table 33.

The difference in modulus of elasticity of steel and aluminum is often the cause of some concern to the designer to whom aluminum is new. Comparing the computed deflections of steel and aluminum beams, for example, may lead him to question the rigidity of aluminum structures.

Experience with actual aluminum structures, however, convinces one that it is misleading to form judgment on this general basis of comparison.

It is sometimes desirable to use an aluminum beam having about the same deflection as a given steel beam. In so doing, it is not necessary to lose the advantage of weight saving, as is indicated in Table 7. It will be noted that increasing the depth is the most effective but not the only means of reducing the deflection for a given loading condition.

TABLE 7

COMPARISON OF BEAM DEFLECTIONS

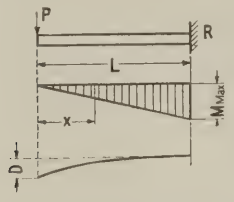
Deflections given are for beams on 10-foot span loaded with 4000 lb. per lin. ft.
Weights given do not include any details.

Material	Depth of Channels in.	Web of Channels in.	Size of Cover Plates in.	Weight of Section lb. per ft.	Deflection of Beam in.
Steel	8	0.220	8 x 1/4	36.6	0.23
25ST	8	0.220	8 x 1/4	13.0	0.68
25ST	8	0.220	8 1/2 x 3/8	15.9	0.51
25ST	8	0.220	9 1/2 x 1/2	19 7	0.38
25ST	10	0.240	8 x 1/4	15.7	0 38
25ST	12	0 280	8 x 1/4	19.5	0 22

TABLE 8

BENDING MOMENTS AND DEFLECTIONS OF BEAMS

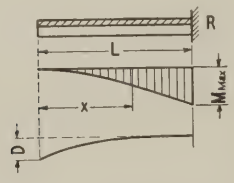
1. CANTILEVER BEAM
Concentrated Load at Free End



Reaction = P
Moment at any point = Px
Maximum Moment = PL

$$\text{Maximum Deflection} = \frac{PL^3}{3EI}$$

2. CANTILEVER BEAM
Uniform Load, w *per unit of length*



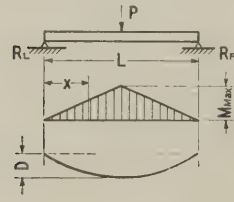
Reaction = wL = W

$$\text{Moment at any point} = \frac{wx^2}{2} = \frac{Wx^2}{2L}$$

$$\text{Maximum Moment} = \frac{wL^2}{2} = \frac{WL}{2}$$

$$\text{Maximum Deflection} = \frac{wL^4}{8EI} = \frac{WL^3}{8EI}$$

3. SIMPLE BEAM
Concentrated Load at Center



Reactions: $R_L = R_R = \frac{P}{2}$

Moment at any point:

$$x < \frac{L}{2}, M = \frac{Px}{2}$$

$$x > \frac{L}{2}, M = \frac{P(L-x)}{2}$$

$$\text{Maximum Moment, at center} = \frac{PL}{4}$$

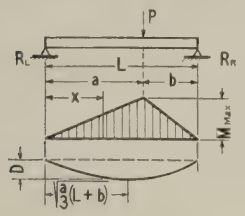
$$\text{Maximum Deflection} = \frac{PL^3}{48EI}$$

TABLE 8—*Continued*

BENDING MOMENTS AND DEFLECTIONS OF BEAMS

4. SIMPLE BEAM

Concentrated Load at any point



Reactions: $R_L = \frac{Pb}{L}$, $R_R = \frac{Pa}{L}$

Moment at any point:

$$x < a,\ M = R_L x = \frac{Pbx}{L}$$

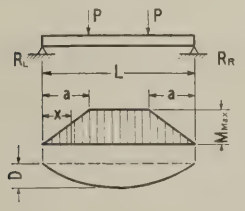
$$x > a,\ M = R_R(L-x) = \frac{Pa(L-x)}{L}$$

Maximum Moment, where $x = a$, $M = \frac{Pab}{L}$

Maximum Deflection, $D = \frac{Pab(L+b)\sqrt{3a(L+b)}}{27\,EIL}$

5. SIMPLE BEAM

Two equal concentrated loads, symmetrically placed



Reactions: $R_L = R_R = P$

Moment at any point:

$$x < a,\ M = R_L x = Px$$

$$a < x < (L-a),\ M = Pa$$

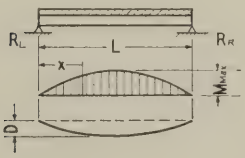
$$x > (L-a),\ M = P(L-x)$$

Maximum Moment: $M = Pa$

Maximum Deflection $= \frac{Pa}{24\,EI}(3L^2 - 4a^2)$

6. SIMPLE BEAM

Uniform Load, w per unit of length, total load W



Reactions: $R_L = R_R = \frac{wL}{2} = \frac{W}{2}$

Moment at any point:

$$M = \frac{wx(L-x)}{2} = \frac{Wx(L-x)}{2L}$$

Maximum Moment, at center: $M = \frac{wL^2}{8} = \frac{WL}{8}$

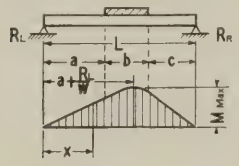
Maximum Deflection: $D = \frac{5wL^4}{384\,EI} = \frac{5WL^3}{384\,EI}$

TABLE 8—*Continued*

BENDING MOMENTS AND DEFLECTIONS OF BEAMS

7. SIMPLE BEAM

Uniform Load, w *per unit of length, on part of span*



Reactions: $R_L = \frac{bw(2c+b)}{2L}$, $R_R = \frac{bw(2a+b)}{2L}$

Moment at any point:

$$x < a,\ M = R_L\, x = \frac{bwx\,(2c+b)}{2L}$$

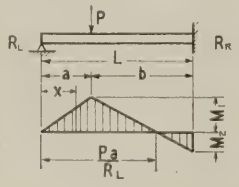
$$a < x < (a+b),\ M = R_L\, x - \frac{(x-a)^2 w}{2}$$

$$x > (a+b),\ M = R_R\,(L-x)$$

Maximum Moment $= \frac{bw(2c+b)\,[4aL+b(2c+b)]}{8L^2}$

8. BEAM FIXED AT ONE END, SIMPLE SUPPORT AT OTHER

Concentrated Load at any point



Reactions: $R_L = \frac{Pb^2}{2L^3}(2L+a)$, $R_R = P - R_L$

Moment at any point:

$$x < a,\ M = R_L\, x = \frac{Pb^2x}{2L^3}(2L+a)$$

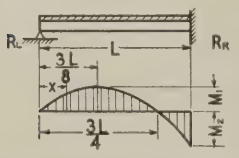
$$x > a,\ M = R_L\, x - P(x-a)$$

$$x = L,\ M_2 = \frac{-Pab}{2L^2}(L+a)$$

$$M_1 = \frac{Pab^2}{2L^3}(2L+a)$$

9. BEAM FIXED AT ONE END, SIMPLE SUPPORT AT OTHER

Uniform Load, w *per unit of length*



Reactions: $R_L = \frac{3}{8}wL$, $R_R = \frac{5}{8}wL$

Moment at any point:

$$x < L,\ M = wx\left(\frac{3L}{8} - \frac{x}{2}\right)$$

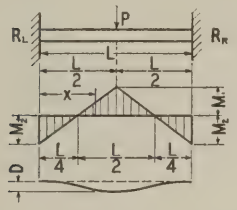
$$x = L,\ M_2 = \frac{-wL^2}{8}$$

$$M_1 = \frac{9wL^2}{128}$$

TABLE 8—*Continued*

BENDING MOMENTS AND DEFLECTIONS OF BEAMS

10. BEAM FIXED AT BOTH ENDS
Concentrated Load at center



Reactions: $R_L = R_R = \frac{P}{2}$

Moment at any point:

$$x = 0,\ x = L,\ M_2 = \frac{-PL}{8}$$

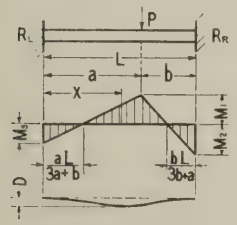
$$x < \frac{L}{2},\ M = \frac{-P}{2}\left(\frac{L}{4} - x\right)$$

$$x > \frac{L}{2},\ M = \frac{P}{2}\left(\frac{3L}{4} - x\right)$$

$$M_1 = \frac{PL}{8}$$

Maximum Deflection $= \frac{PL^3}{192\ EI}$

11. BEAM FIXED AT BOTH ENDS
Concentrated Load at any point



Reactions: $R_L = \frac{Pb^2}{L^3}(L+2a)$, $R_R = \frac{Pa^2}{L^3}(L+2b)$

Moment at any point:

$$x = 0,\ M_3 = \frac{-Pab^2}{L^2}$$

$$x < a,\ M = \frac{-Pab^2}{L^2} + R_L\,x$$

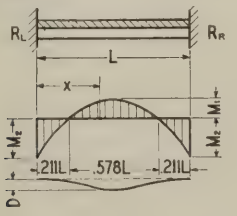
$$x > a,\ M = \frac{-Pa^2b}{L^2} + R_R\,(L-x)$$

$$x = L,\ M_2 = \frac{-Pa^2b}{L^2}$$

$$M_1 = \frac{2Pa^2b^2}{L^3}$$

Maximum Deflection, $a > b$, $= \frac{2\,P\,a^3b^2}{3\,E\,I\,(3a+b)^2}$

12. BEAM FIXED AT BOTH ENDS
Uniform Load, w *per unit of length, total load* W



Reactions: $R_L = R_R = \frac{wL}{2} = \frac{W}{2}$

Moment at any point:

$$x = 0,\ x = L,\ M_2 = \frac{-wL^2}{12} = \frac{-WL}{12}$$

$$x < L,\ M = \frac{-wL^2}{12} - \frac{wx^2}{2} + \frac{wLx}{2}$$

$$M_1 = \frac{wL^2}{24} = \frac{WL}{24}$$

Maximum Deflection $= \frac{wL^4}{384\ EI}$

THE STRUCTURAL USE OF VARIOUS ALLOYS

IT is impossible to give fixed rules for the selection of the proper aluminum alloy for a given purpose. The discussion below is designed to point out the important characteristics of the different alloys as a guide to the user's choice. The mechanical properties of these alloys are given in Table 3.

3S ALLOY

3S is used in structural work where strength is not of primary importance or where welding is necessary. It is used for tank cars, storage containers, car and bus body plates, window sash, corrugated roofing, and the like. It is generally used in the hardest temper suitable to the necessary shop work.

17S ALLOY

Since 17S ages naturally at room temperatures following heat-treatment, it does not have a stable W condition. 17ST has mechanical properties comparable with those of ordinary structural steel and is used for important strength members in railway cars, street cars, busses, trucks, airplanes, traveling cranes, scaffolding, and boats.

25S ALLOY

As pointed out previously, 25S does not age at ordinary temperatures and this makes it possible to keep it indefinitely in the unaged or W condition. 25SW has not been used to any great extent in structures, the T condition usually being preferred. 25ST has the same mechanical properties as 17ST and hence is used for about the same purposes.

51S ALLOY

51S in the W condition is very workable and hence is adapted to severe forming operations. 51SW is used in body framing of railway cars and busses and in various welded constructions where 3S is not strong enough. As pointed out elsewhere, it can be aged to 51ST after forming, thereby gaining additional strength. 51ST has the same yield point as 17ST and 25ST but its other mechanical properties are somewhat lower, as indicated in Table 3.

CASTING ALLOYS

The casting alloys are produced in the form of notched ingots of convenient size for remelting. They can be readily handled in the foundry and make excellent castings. Aluminum casting alloys may be purchased as ingots or in the form of finished castings. They machine easily and have a pleasing appearance.

No. 12 alloy can be used structurally to about the same extent as cast iron. When a tight, leak-proof casting is needed, No. 43 is recommended. No. 195-4 alloy is heat-treated to give it high mechanical properties and has been used in many cases to replace malleable iron castings. As indicated in Table 3, the yield point of 195-4 is raised materially by natural aging over a period of several months. This aging process can also be carried out artificially in a few hours.

CONSTRUCTION PRACTICE FOR ALUMINUM ALLOYS

IN order that the user who is unfamiliar with the handling of aluminum may proceed to the best advantage, the methods used in the more experienced shops will be briefly discussed.

COLD FORMING

Shapes may often be formed cold from sheet or plate. Of the strong alloy materials, 51SW is best suited for cold forming because it is the most ductile. Fairly difficult operations are possible with it. After a shape has been cold formed from 51SW it may be aged to 51ST thereby obtaining maximum properties. 17ST, 25SW, and 25ST lend themselves to cold forming as ordinarily performed with a power brake but are not sufficiently ductile to permit difficult cold forming operations.

Before cold forming is attempted on a production scale, the minimum bend radius of the material should be determined by experiment with the tools to be used. Table 9 gives some information on bend radii but cannot take the place of actual trials in the shop on account of variations in equipment.

HOT FORMING

Hot forming is generally employed when shapes are required that cannot be formed cold. If the shape is such that it does not lend itself to heat-treatment after forming, the operation is performed at a temperature between 890° and 940°F., the entire piece of metal being uniformly preheated to this temperature. It is transferred to the forming tools and formed in a minimum amount of time in order to effect a die quench by contact with the relatively cold tools. Such hot forming operations are similar to those commonly per-

TABLE 9

APPROXIMATE RADII FOR 90° COLD BENDS

The values given below represent average shop practice for production conditions. Considerably shorter radii can be used if special care is taken.*

t = thickness of sheet.

Alloy and Temper	Bend radii for different thicknesses of sheet		
	1/16 inch Sheet	1/8 inch Sheet	1/4 inch Sheet
3SO	0	0	0
3S½H	0	t	t
3SH	t	3t	4t
17SO	0	0	t
17ST	2t	3t	5t
25SW	2t	3t	5t
25ST	2t	4t	6t
51SW	t	2t	4t
51ST	3t	6t	..

*In order to use short radii successfully, sharp corners and burrs should be removed from the edges of the sheet near the bend line. This minimizes the tendency for cracking to start from the edges. Smooth, clean, well lubricated tools should be used. It is preferable that the axis of the bend be at right angles to the direction of rolling.

formed on steel with the exception that the preheating temperature is more closely controlled. 17S is the alloy generally chosen for this operation and after hot forming exhibits the mechanical characteristics of the heat-treated material.

Hot forming as accomplished in the ordinary blacksmith shop is handled in much the same manner when working aluminum alloys. The metal may be heated locally on a hot plate or by means of a blowtorch or electric furnace, care being taken that the temperature does not exceed 950°F. A contact pyrometer which instantaneously indicates surface temperature should always be used to guard against overheating. The work is formed while hot in the customary manner. After such operations the piece should be heat-treated in order to obtain the desired mechanical properties. In some cases, however, when the point of forming is in a part of a member that is not highly stressed, the forming may be done on heat-treated material without reheat-treatment, care being taken to confine the heating to those por-

tions which are not highly stressed. The lower the temperature and the shorter the time at maximum temperature, the better will be the mechanical properties in the heated area. A temperature up to 400°F. may be used for 15 minutes without appreciably affecting the properties of the heat-treated material and at this temperature the ductility of the heat-treated material is greatly increased.

SHEARING

Aluminum alloy plates and shapes may be sheared with the equipment ordinarily used for steel. A clean sheared edge will result if the shear blades are sharp and the clearance is about one-eighth the thickness of the material to be sheared. Aluminum alloys require less power for shearing than does steel.

SAWING

Both band and circular saws are used for sawing aluminum. High speed metal cutting band saws or heavy duty wood cutting band saws are used. For the best results a blade speed of about 5000 feet per minute is recommended. Circular saws with hollow ground blades are satisfactory for light work, but for heavy work the teeth should be swaged in order to provide clearance and prevent overheating. Coarse-toothed blades should be used for both band and circular saws and the teeth should have no top rake. A peripheral speed of about 12,000 feet per minute is recommended for the best results for circular saws. The lubricants used are discussed under the section on "Machining."

BURNING

Burning as a means of cutting is not commonly used on aluminum due to the fact that the heat required will locally lower the mechanical properties of the material. Where this factor is not an objection, as may be the case in cutting holes in tank walls, burning may be used. Since the metal is simply melted away and not consumed, very ragged edges result.

PUNCHING AND DRILLING RIVET HOLES

Rivet holes in aluminum materials may be either drilled, punched, or sub-punched and reamed as desired. When holes are drilled or sub-punched and reamed, the diameter of the hole is generally made 1/32 inch greater than the diameter of the rivet. For heavier work where holes are formed by punching, the diameter of the hole is generally made 1/16 inch greater than the diameter of the rivet. Clean sharp punches will produce good holes. For best results the diameter of the die should be greater than the diameter of the punch by an amount equal to about one-fourth the thickness of the material being punched. Taper bridge reamers with spiral flutes are recommended for reaming sub-punched holes to size.

RIVETING

Both aluminum and steel rivets are used for assembling aluminum structures. Because of their ease of driving, 3S cold driven rivets are used in joints where it is not necessary to develop maximum strength. Where the maximum strength must be developed, 17S or steel rivets are required. If steel rivets are used they may be hot driven according to the customary steel practice. It may be advisable to drive hot steel rivets at random, rather than progressively from end to end, because localized heating may result in deforming the structure somewhat.

17S rivets should generally be driven cold in sizes up to and including 3/8 inch and hot riveted in sizes greater than 3/8 inch. Cold driving of 17S rivets should be done within one hour after heat-treatment, which means that heat-treating equipment must be near the work. Such equipment usually consists of a small oil or gas fired melting pot in which sodium nitrate may be fused and maintained at a temperature of 950°F. The rivets are placed in a wire basket, immersed in the fused nitrate and maintained at this temperature for about ten minutes, whereupon they are removed and quickly quenched in water. Any other means of heating which is susceptible to the control of temperature within

the required limits may be used. When quenched rivets become too hard to drive satisfactorily, they may be reheat-treated.

In the hot driving procedure, 17S rivets are first heated to a temperature of from 940° to 960° F., an electric furnace or lead bath generally being used as the heating medium. The rivets are then transferred from the furnace to the rivet holes and driven, with a minimum lapse of time. The cold metal around the hole provides a quench for the hot rivet and practically full 17ST properties are developed in the rivet.

For cold driving 17S rivets, a hammer should be chosen which would ordinarily be used for driving a hot steel rivet whose diameter is two and one-half to three times that of the 17S rivet. For hot driving 17S rivets, a hammer should be chosen which would be used for a hot steel rivet of about twice the diameter of the 17S rivet. Experience indicates that the compression or squeeze method of riveting is faster and better than the hammer method and consequently should be used where possible.

Design values for both aluminum and steel rivets are given in Table 17.

WELDING

Fusion welding by means of an oxy-hydrogen or oxy-acetylene torch is widely used in aluminum construction. Electric spot welding is also used and considerable progress has been made with electric arc and butt welding.

Welding in aluminum, as in other metals, is an art that requires skill and training for satisfactory results. However, it does not require undue time to train men for such work.

The metal in a weld is in the cast condition. Therefore when ductility and strength are important, it is desirable that the weld be hammered to cold-work the material. This tends to modify the cast structure. In designing, it should also be remembered that the material adjacent to a weld is in the annealed or partially annealed condition unless it is subsequently heat-treated.

The bead formed in welding aluminum is fairly smooth and not too large to be left as welded for ordinary structural work. When the work requires a specially neat, smooth surface, the bead can be easily dressed down and finished.

Welds are used most often in 3S material. In the strong alloys, welding is usually practical only under certain conditions because of the effect of heat on the properties of the material. When a joint comes at a point of low stress in a strong alloy structure, welding may often be used to advantage. When a structure is of such a size and shape that the joints are accessible for hammering and the completed assembly can be heat-treated, welding becomes an efficient method of joining. For the majority of joints in strong aluminum alloy structures, however, riveting is more practical and more often used.

SCREWS AND BOLTS

Aluminum screws and bolts are usually made from the high strength aluminum alloys. 17ST alloy is perhaps the most commonly used although 25ST and 51ST are also quite generally employed. Since the ultimate strength and yield point of 17ST are about the same as those of steel, it follows that bolts made of this alloy have approximately the same strength in tension and compression as ordinary steel bolts. It is likewise true that such bolts will have practically the same strength as steel bolts in flexure or bending. Owing to the difference in shear strength, aluminum bolts are only about 75 per cent as strong in shear and torsion as steel bolts. Hence, it is often necessary to use a 17ST bolt about one size larger than would be used in steel, especially when the bolts are used in places where they must be drawn up tightly. This applies particularly to the smaller sizes.

When drawn up tightly aluminum bolts have a tendency to seize in the threads. This can be prevented by the use of a suitable lubricant such as "Alcoa Anti-Seize Compound" or certain heavy oils. Kerosene should not be used for this purpose.

MACHINING

For structural work, aluminum alloys may in most instances be machined fairly satisfactorily with the same tools that would be used for steel, provided that the tools are in first class condition. Better results can be obtained, however, by using tools somewhat different from those ordinarily provided for steel and brass. Cutting tools commonly used for brass have little, if any, top and side rake. Tools ordinarily used for steel have some top and side rake. The proper cutting tools for aluminum alloys should have appreciably more top and side rake than tools for cutting steel; they should have very keen edges and they should be ground with a fine abrasive; in fact the edges must be very smooth and the surfaces must be free from burrs, scratches, or roughness such as might result from the use of a rough abrasive. In appearance, therefore, lathe, planer, and shaper tools for aluminum approach more nearly woodworking tools, owing to the keen angle of the cutting edge. Milling cutters should be of the coarse-tooth spiral type, with considerable top rake on their cutting edges. Taps and dies should have considerable top rake on the cutting edges; taps with spiral flutes, or at least with a short spiral at the point extending back several teeth, are recommended.

A suitable cutting compound or lubricant should be used for machining or sawing aluminum. Generally speaking, soluble compounds are quite satisfactory for milling, sawing, and drilling. Band saws may be lubricated satisfactorily with wipe oilers using reclaimed lubricating oil. Ordinary kerosene will often serve well, but for tapping and general machining, a mixture of about equal parts of kerosene and lard oil is preferred.

FINISHING ALUMINUM SURFACES FOR PROTECTION OR DECORATION

ALTHOUGH aluminum and its alloys do not rust, under certain severe conditions of exposure it is desirable to protect them by some form of paint or other coating as in the case of other metals. This is particularly a wise precaution when using thin sections of certain of the alloys which are somewhat more susceptible than the pure metal. For ordinary conditions of use, such as railway cars, automobiles, etc., the finishing system used on similar steel structures may generally be employed, with perhaps fewer coats being required for the aluminum. Either a lacquer system or oil base system may be used. When it is desired to retain the aluminum color, aluminum paint made with a hard-drying varnish vehicle forms an excellent coating.

In preparing aluminum or its alloys for paint, it is often desirable either to roughen the surface lightly by means of a light sand blast, or scratch brushing, or to apply a special oxide coating by means of a chemical dip or by an electrolytic process. In all cases a clean surface, free of oil, is essential.

As a priming coat, zinc chromate has been found to be quite effective. Red oxide of iron paint containing about 15 per cent zinc chromate, or aluminum paint made with a hard-drying spar varnish are also very good priming paints. For the finishing coats, aluminum paint is perhaps the most durable. Where different finishing colors are desired, lead base paint, pyroxylin lacquers, or enamels can be used.

For resistance to alkali, bituminous coatings are recommended for application to aluminum surfaces. These coatings usually show remarkably good adherence and are normally unaffected by alkali. Care should be taken to select a durable bituminous paint for this purpose.

Paint coatings may be applied to aluminum surfaces by employing practically the same procedure and materials as

in the case of steel, tin plate, or any other metallic surface. Because of the smoothness of aluminum sheet, a roughened finish is preferable. Aluminum castings normally present a sufficiently rough surface for good paint adherence.

STRUCTURAL ALUMINUM HANDBOOK

PART II

STRUCTURAL SHAPES

ELEMENTS OF SECTIONS

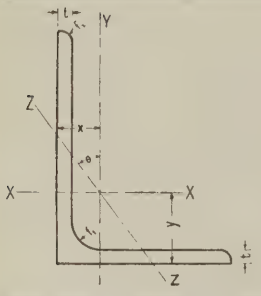
In the following group of tables, the structural shapes are arranged in this order:

Angles — Car Channels
I-Beams — H-Beams
Channels — Tees
Zees

THE dimensions given represent the theoretical dimensions of the shapes. The actual dimensions of a shape will usually overrun slightly, depending upon the condition of the rolls or die at the time it is produced. The elements of sections are computed on the basis of theoretical dimensions, fillets and roundings included. For most of the sections only two axes are used, XX and YY, the latter being the axis of least moment of inertia. In the case of the unsymmetrical shapes, Angles and Zees, the axis of least moment of inertia is at an angle to the other two and is designated as ZZ.

The weights given for the shapes and for the rectangular sections in Table 10 are based on 17S and 25S. The weights based on other alloys may be found as follows:

For 3S multiply by 0.983
For 51S multiply by 0.965



ANGLES

ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I = Moment of Inertia in in.^{4}
S = Section Modulus in in.^{3}
r = Radius of Gyration in inches.

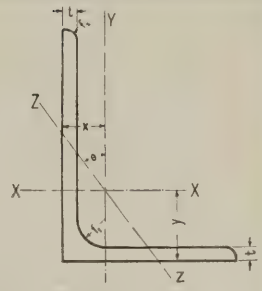
Size	Legs	7/16 x 7/16	5/8 x 5/8	3/4 x 3/4			1 x 1		
	t	3/32	3/32	3/32	1/8	3/16	1/8	3/16	1/4
Wt.		0.09	0.13	0.16	0.21	0.30	0.28	0.41	0.53
Area		0.07	0.11	0.13	0.17	0.25	0.23	0.34	0.44
f_1		3/32	1/8	1/8	1/8	1/8	1/8	1/8	1/8
f_2		3/64	3/64	3/32	3/32	3/32	3/32	3/32	3/32
Axis X-X	I	0.001	0.004	0.006	0.008	0.011	0.021	0.029	0.036
	S	0.004	0.008	0.012	0.016	0.022	0.029	0.042	0.054
	r	0.12	0.18	0.22	0.22	0.21	0.30	0.29	0.29
	y	0.14	0.19	0.21	0.23	0.25	0.29	0.31	0.34
Axis Y-Y	I	0.001	0.004	0.006	0.008	0.011	0.021	0.029	0.036
	S	0.004	0.008	0.012	0.016	0.022	0.029	0.042	0.054
	r	0.12	0.18	0.22	0.22	0.21	0.30	0.29	0.29
	x	0.14	0.19	0.21	0.23	0.25	0.29	0.31	0.34
Axis Z-Z	Θ	45° 0′	45° 0′	45° 0′	45° 0′	45° 0′	45° 0′	45° 0′	45° 0′
	I	....	0.002	0.003	0.003	0.005	0.009	0.012	0.016
	r	0.07	0.12	0.14	0.14	0.14	0.19	0.19	0.19

Size	Legs	1 1/4 x 1 1/4				1 1/2 x 1 1/4			
	t	1/8	3/16	1/4	5/16	1/8	3/16	1/4	5/16
Wt.		0.36	0.53	0.68	0.83	0.40	0.58	0.76	0.92
Area		0.30	0.43	0.56	0.68	0.33	0.48	0.63	0.76
f_1		3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16
f_2		1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Axis X-X	I	0.042	0.059	0.074	0.088	0.070	0.100	0.127	0.151
	S	0.046	0.068	0.087	0.106	0.066	0.097	0.126	0.153
	r	0.37	0.37	0.36	0.36	0.46	0.46	0.45	0.44
	y	0.35	0.37	0.40	0.42	0.44	0.47	0.49	0.52
Axis Y-Y	I	0.042	0.059	0.074	0.088	0.044	0.063	0.079	0.093
	S	0.046	0.068	0.087	0.106	0.047	0.069	0.090	0.109
	r	0.37	0.37	0.36	0.36	0.37	0.36	0.36	0.35
	x	0.35	0.37	0.40	0.42	0.32	0.35	0.37	0.39
Axis Z-Z	Θ	45° 0′	45° 0′	45° 0′	45° 0′	33° 59′	33° 53′	33° 36′	33° 15′
	I	0.017	0.025	0.032	0.040	0.022	0.032	0.041	0.050
	r	0.24	0.24	0.24	0.24	0.26	0.26	0.26	0.26

ANGLES

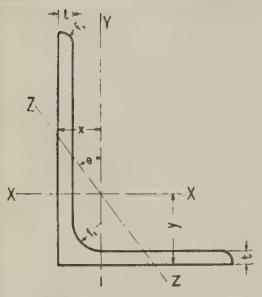
ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I = Moment of Inertia in in.^{4}
S = Section Modulus in in.^{3}
r = Radius of Gyration in inches.



Size	Legs	1½ x 1½					1¾ x 1⅛	1¾ x 1¼		
	t	⅛	3/16	¼	5/16	⅜	3/16	⅛	3/16	¼
Wt.		0.44	0.64	0.83	1.02	1.19	0.61	0.44	0.64	0.83
Area		0.36	0.53	0.69	0.84	0.99	0.51	0.36	0.53	0.69
f_1		3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16
f_2		⅛	⅛	⅛	⅛	⅛	3/32	⅛	⅛	⅛
Axis X-X	I	0.074	0.107	0.135	0.161	0.184	0.152	0.108	0.156	0.199
	S	0.068	0.100	0.130	0.158	0.185	0.132	0.090	0.132	0.172
	r	0.45	0.45	0.44	0.44	0.43	0.55	0.55	0.54	0.54
	y	0.41	0.44	0.46	0.48	0.51	0.59	0.54	0.57	0.60
Axis Y-Y	I	0.074	0.107	0.135	0.161	0.184	0.049	0.046	0.066	0.083
	S	0.068	0.100	0.130	0.158	0.185	0.058	0.048	0.071	0.092
	r	0.45	0.45	0.44	0.44	0.43	0.31	0.36	0.35	0.35
	x	0.41	0.44	0.46	0.48	0.51	0.29	0.30	0.32	0.35
Axis Z-Z	Θ	45° 0′	45° 0′	45° 0′	45° 0′	45° 0′	21° 47′	26° 22′	26° 08′	25° 47′
	I	0.031	0.044	0.057	0.070	0.083	0.029	0.026	0.037	0.048
	r	0.29	0.29	0.29	0.29	0.29	0.24	0.27	0.26	0.26

Size	Legs	1¾ x 1¾						2 x 1¼		
	t	⅛	3/16	¼	5/16	⅜	7/16	⅛	3/16	¼
Wt.		0.51	0.75	0.98	1.21	1.42	1.62	0.47	0.70	0.91
Area		0.42	0.62	0.81	1.00	1.17	1.34	0.39	0.58	0.75
f_1		3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16
f_2		⅛	⅛	⅛	⅛	⅛	⅛	⅛	⅛	⅛
Axis X-X	I	0.121	0.174	0.223	0.266	0.306	0.342	0.158	0.228	0.291
	S	0.094	0.139	0.181	0.221	0.259	0.295	0.117	0.172	0.224
	r	0.53	0.53	0.52	0.52	0.51	0.50	0.63	0.63	0.62
	y	0.47	0.50	0.52	0.55	0.57	0.59	0.65	0.68	0.70
Axis Y-Y	I	0.121	0.174	0.223	0.266	0.306	0.342	0.047	0.068	0.086
	S	0.094	0.139	0.181	0.221	0.259	0.295	0.049	0.072	0.093
	r	0.53	0.53	0.52	0.52	0.51	0.50	0.35	0.34	0.34
	x	0 47	0.50	0.52	0.55	0.57	0.59	0.28	0.31	0.33
Axis Z-Z	(-)	45° 0′	45° 0′	45° 0′	45° 0′	45° 0′	45° 0′	21° 05′	20° 52′	20° 31′
	I	0 050	0.072	0.093	0.113	0.134	0.155	0.028	0.041	0.053
	r	0 34	0.34	0.34	0.34	0.34	0.34	0.27	0.27	0.26



ANGLES

ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I = Moment of Inertia in in.^{4}
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Size	Legs	2 X 1½					2 X 2					
	t	⅛	3/16	¼	5/16	⅜	⅛	3/16	¼	5/16	⅜	7/16
Wt.		0.51	0.75	0.98	1.21	1.42	0.59	0.87	1.14	1.40	1.65	1.89
Area		0.42	0.62	0.81	1.00	1.17	0.49	0.72	0.94	1.16	1.37	1.57
f_1		3/16	3/16	3/16	3/16	3/16	¼	¼	¼	¼	¼	¼
f_2		⅛	⅛	⅛	⅛	⅛	⅛	⅛	⅛	⅛	⅛	⅛
Axis X-X	I	0.17	0.24	0.31	0.37	0.43	0.18	0.27	0.34	0.41	0.47	0.53
	S	0.12	0.18	0.23	0.28	0.33	0.13	0.19	0.24	0.30	0.35	0.39
	r	0.63	0.62	0.62	0.61	0.60	0.61	0.61	0.60	0.60	0.59	0.58
	y	0.60	0.63	0.66	0.68	0.70	0.53	0.56	0.58	0.61	0.63	0.65
Axis Y-Y	I	0.08	0.12	0.15	0.18	0.20	0.18	0.27	0.34	0.41	0.47	0.53
	S	0.07	0.10	0.14	0.16	0.19	0.13	0.19	0.24	0.30	0.35	0.39
	r	0.44	0.43	0.43	0.42	0.41	0.61	0.61	0.60	0.60	0.59	0.58
	x	0.36	0.38	0.41	0.43	0.45	0.53	0.56	0.58	0.61	0.63	0.65
Axis Z-Z	Θ	28°44′	28°36′	28°20′	28°0′	27°37′	45°0′	45°0′	45°0′	45°0′	45°0′	45°0′
	I	0.04	0.06	0.08	0.10	0.12	0.08	0.11	0.14	0.17	0.20	0.23
	r	0.32	0.32	0.32	0.32	0.32	0.40	0.39	0.39	0.39	0.39	0.39

Size	Legs	2¼ X 1½						2½ X 1¼	2½ X 1½		
	t	3/16	¼	5/16	⅜	7/16	½	3/16	3/16	¼	5/16
Wt.		0.82	1.07	1.31	1.54	1.76	1.97	0.82	0.87	1.14	1.40
Area		0.67	0.88	1.08	1.27	1.46	1.63	0.68	0.72	0.94	1.16
f_1		¼	¼	¼	¼	¼	¼	¼	¼	¼	¼
f_2		⅛	⅛	⅛	⅛	⅛	⅛	3/32	⅛	⅛	⅛
Axis X-X	I	0.34	0.43	0.52	0.60	0.68	0.74	0.43	0.46	0.59	0.71
	S	0.22	0.29	0.36	0.42	0.48	0.53	0.27	0.27	0.36	0.44
	r	0.71	0.70	0.70	0.69	0.68	0.68	0.80	0.79	0.79	0.78
	y	0.73	0.76	0.78	0.81	0.83	0.85	0.89	0.84	0.86	0.89
Axis Y-Y	I	0.12	0.15	0.18	0.21	0.23	0.26	0.07	0.12	0.16	0.19
	S	0.11	0.14	0.17	0.20	0.22	0.25	0.08	0.11	0.14	0.17
	r	0.42	0.42	0.41	0.41	0.40	0.40	0.33	0.41	0.41	0.40
	x	0.36	0.39	0.41	0.44	0.46	0.48	0.28	0.35	0.37	0.39
Axis Z-Z	Θ	23°22′	23°09′	22°50′	22°26′	21°57′	21°26′	14°29′	19°38′	19°25′	19°06′
	I	0.07	0.09	0.11	0.13	0.15	0.17	0.05	0.08	0.10	0.12
	r	0.32	0.32	0.32	0.32	0.32	0.32	0.27	0.32	0.32	0.32

ANGLES

ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
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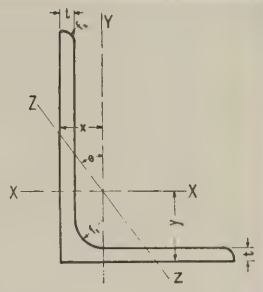
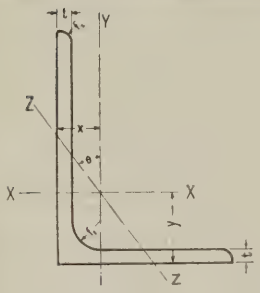


Size	Legs	2½ X 2						
	t	1/8	3/16	1/4	5/16	3/8	7/16	1/2
Wt.		0.67	0.99	1.29	1.59	1.88	2.16	2.43
Area		0.55	0.82	1.07	1.32	1.55	1.78	2.01
f_1		1/4	1/4	1/4	1/4	1/4	1/4	1/4
f_2		1/8	1/8	1/8	1/8	1/8	1/8	1/8
Axis X-X	I	0.34	0.50	0.65	0.78	0.91	1.02	1.13
	S	0.19	0.29	0.38	0.46	0.54	0.62	0.69
	r	0.79	0.78	0.78	0.77	0.76	0.76	0.75
	y	0.72	0.75	0.78	0.80	0.83	0.85	0.87
Axis Y-Y	I	0.20	0.29	0.37	0.44	0.51	0.57	0.63
	S	0.13	0.19	0.25	0.30	0.36	0.41	0.46
	r	0.60	0.59	0.58	0.58	0.57	0.57	0.56
	x	0.48	0.51	0.53	0.55	0.58	0.60	0.62
Axis Z-Z	Θ	31°57′	31°58′	31°51′	31°41′	31°28′	31°13′	30°56′
	I	0.10	0.15	0.19	0.23	0.27	0.31	0.35
	r	0.43	0.42	0.42	0.42	0.42	0.42	0.42

Size	Legs	2½ X 2½							3 X 1½
	t	1/8	3/16	1/4	5/16	3/8	7/16	1/2	1/4
Wt.		0.75	1.10	1.45	1.78	2.11	2.42	2.73	1.30
Area		0.62	0.91	1.19	1.47	1.74	2.00	2.26	1.08
f_1		1/4	1/4	1/4	1/4	1/4	1/4	1/4	5/16
f_2		1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Axis X-X	I	0.37	0.54	0.69	0.84	0.98	1.10	1.22	0.98
	S	0.20	0.30	0.39	0.48	0.56	0.64	0.72	0.51
	r	0.77	0.77	0.76	0.76	0.75	0.74	0.73	0.95
	y	0.65	0.68	0.71	0.73	0.76	0.78	0.80	1.08
Axis Y-Y	I	0.37	0.54	0.69	0.84	0.98	1.10	1.22	0.16
	S	0.20	0.30	0.39	0.48	0.56	0.64	0.72	0.14
	r	0.77	0.77	0.76	0.76	0.75	0.74	0.73	0.39
	x	0.65	0.68	0.71	0.73	0.76	0.78	0.80	0.34
Axis Z-Z	Θ	45° 0′	45° 0′	45° 0′	45° 0′	45° 0′	45° 0′	45° 0′	14°22′
	I	0.15	0.22	0.29	0.35	0.41	0.47	0.53	0.11
	r	0.50	0.49	0.49	0.49	0.48	0.48	0.48	0.32



ANGLES

ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I = Moment of Inertia in in.^{4}
S = Section Modulus in in.^{3}
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Size	Legs	3 x 2					3 x 2½				
	t	¼	5/16	3/8	7/16	½	¼	5/16	3/8	7/16	½
Wt.		1.44	1.78	2.11	2.42	2.73	1.58	1.95	2.32	2.67	3.02
Area		1.19	1.47	1.74	2.00	2.26	1.31	1.62	1.92	2.21	2.49
f_1		5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16
f_2		3/16	3/16	3/16	3/16	3/16	¼	¼	¼	¼	¼
Axis X-X	I	1.06	1.29	1.51	1.71	1.90	1.12	1.37	1.60	1.82	2.03
	S	0.52	0.65	0.76	0.88	0.99	0.53	0.66	0.78	0.90	1.01
	r	0.94	0.94	0.93	0.92	0.92	0.92	0.92	0.91	0.91	0.90
	y	0.97	1.00	1.03	1.05	1.07	0.89	0.92	0.94	0.97	0.99
Axis Y-Y	I	0.38	0.45	0.53	0.59	0.66	0.70	0.86	1.00	1.14	1.26
	S	0.25	0.30	0.36	0.41	0.46	0.38	0.47	0.55	0.64	0.72
	r	0.56	0.56	0.55	0.55	0.54	0.73	0.73	0.72	0.72	0.71
	x	0.48	0.51	0.53	0.56	0.58	0.64	0.67	0.69	0.72	0.74
Axis Z-Z	Θ	23°22′	23°13′	23°0′	22°44′	22°25′	34°03′	34°0′	33°54′	33°46′	33°37′
	I	0.22	0.27	0.31	0.36	0.40	0.35	0.43	0.51	0.58	0.65
	r	0.43	0.43	0.42	0.42	0.42	0.52	0.51	0.51	0.51	0.51

Size	Legs	3 x 3						
	t	¼	5/16	3/8	7/16	½	9/16	5/8
Wt.		1.73	2.14	2.55	2.94	3.32	3.69	4.06
Area		1.43	1.77	2.10	2.43	2.74	3.05	3.35
f_1		5/16	5/16	5/16	5/16	5/16	5/16	5/16
f_2		¼	¼	¼	¼	¼	¼	¼
Axis X-X	I	1.18	1.45	1.70	1.94	2.16	2.37	2.57
	S	0.54	0.67	0.80	0.92	1.04	1.15	1.26
	r	0.91	0.91	0.90	0.89	0.89	0.88	0.88
	y	0.82	0.85	0.87	0.90	0.92	0.94	0.97
Axis Y-Y	I	1.18	1.45	1.70	1.94	2.16	2.37	2.57
	S	0.54	0.67	0.80	0.92	1.04	1.15	1.26
	r	0.91	0.91	0.90	0.89	0.89	0.88	0.88
	x	0.82	0.85	0.87	0.90	0.92	0.94	0.97
Axis Z-Z	Θ	45°0′	45°0′	45°0′	45°0′	45°0′	45°0′	45°0′
	I	0.49	0.60	0.70	0.81	0.91	1.01	1.12
	r	0.58	0.58	0.58	0.58	0.58	0.58	0.58

ANGLES

ELEMENTS OF SECTIONS

All Dimensions in inches.
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Area in square inches.
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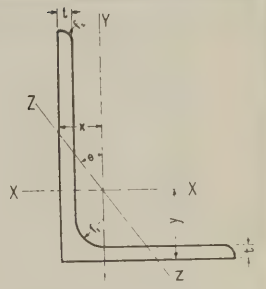
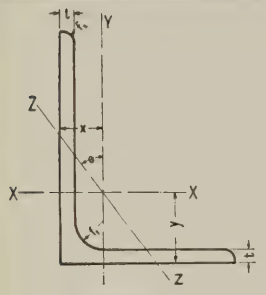


Size	Legs	3½ x 2½					3½ x 3				
	t	¼	5/16	3/8	7/16	½	¼	5/16	3/8	7/16	½
Wt.		1.73	2.14	2.55	2.94	3.32	1.89	2.34	2.78	3.21	3.63
Area		1.43	1.77	2.10	2.43	2.74	1.57	1.94	2.30	2.66	3.00
f_1		5/16	5/16	5/16	5/16	5/16	3/8	3/8	3/8	3/8	3/8
f_2		¼	¼	¼	¼	¼	¼	¼	¼	¼	¼
Axis X-X	I	1.73	2.12	2.49	2.84	3.17	1.84	2.26	2.65	3.03	3.38
	S	0.72	0.89	1.06	1.22	1.37	0.74	0.92	1.09	1.26	1 42
	r	1.10	1.09	1.09	1.08	1.08	1.08	1.08	1.07	1.07	1.06
	y	1.09	1.12	1.14	1.17	1.19	1.01	1.04	1.06	1.09	1 11
Axis Y-Y	I	0.73	0.89	1.05	1.19	1.32	1.28	1.52	1.79	2.04	2.27
	S	0.38	0.48	0.57	0.65	0.73	0.57	0.69	0.82	0.94	1.06
	r	0.71	0.71	0.71	0.70	0.69	0.90	0.89	0.88	0.88	0.87
	x	0.60	0.62	0.65	0.67	0.70	0.76	0.79	0.82	0.84	0.86
AxisZ-Z	Θ	26°23′	26°18′	26°10′	26°0′	25°48′	36°13′	35°40′	35°37′	35°32′	35°26′
	I	0.41	0.50	0.59	0.67	0.76	0.63	0.74	0.87	1.00	1.13
	r	0.53	0.53	0.53	0.53	0.53	0.63	0.62	0.62	0.61	0.61

Size	Legs	3½ x 3½						
	t	¼	5/16	3/8	7/16	½	9/16	5/8
Wt.		2.05	2.53	3.01	3.48	3.94	4.39	4.83
Area		1.69	2.09	2.49	2.87	3.25	3.62	3.99
f_1		3/8	3/8	3/8	3/8	3/8	3/8	3/8
f_2		¼	¼	¼	¼	¼	¼	¼
Axis X-X	I	1.93	2.37	2.79	3.18	3.56	3.92	4.26
	S	0.76	0.94	1.11	1.28	1.45	1.61	1.77
	r	1.07	1.06	1.06	1.05	1.05	1.04	1.03
	y	0.94	0.97	1.00	1.02	1.05	1.07	1.09
Axis Y-Y	I	1.93	2.37	2.79	3.18	3.56	3.92	4.26
	S	0.76	0.94	1.11	1.28	1.45	1.61	1 77
	r	1.07	1.06	1.06	1.05	1.05	1.04	1.03
	x	0.94	0.97	1.00	1.02	1.05	1.07	1.09
AxisZ-Z	Θ	45°0′	45°0′	45°0′	45°0′	45°0′	45°0′	45°0′
	I	0.80	0.98	1.15	1.32	1.49	1.65	1.81
	r	0.69	0.68	0.68	0.68	0.68	0.67	0.67



ANGLES

ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I = Moment of Inertia in $in.^4$
S = Section Modulus in $in.^3$
r = Radius of Gyration in inches.

Size	Legs	4 x 3							4 x 3½			
	t	¼	5/16	⅜	7/16	½	9/16	⅝	5/16	⅜	7/16	½
Wt.		2.05	2.53	3.01	3.48	3.94	4.39	4.83	2.70	3.22	3.72	4.22
Area		1.69	2.09	2.49	2.87	3.25	3.62	3.99	2.23	2.66	3.08	3.49
f_1		⅜	⅜	⅜	⅜	⅜	⅜	⅜	⅜	⅜	⅜	⅜
f_2		¼	¼	¼	¼	¼	¼	¼	5/16	5/16	5/16	5/16
Axis X-X	I	2.68	3.29	3.88	4.43	4.96	5.47	5.95	3.40	4.02	4.61	5.17
	S	0.96	1.19	1.42	1.63	1.85	2.05	2.25	1.19	1.43	1.65	1.87
	r	1.26	1.25	1.25	1.24	1.24	1.23	1.22	1.23	1.23	1.22	1.22
	y	1.21	1.24	1.26	1.29	1.31	1.34	1.36	1.15	1.18	1.21	1.23
Axis Y-Y	I	1.29	1.58	1.86	2.12	2.36	2.60	2.82	2.42	2.85	3.27	3.67
	S	0.56	0.70	0.83	0.96	1.08	1.20	1.32	0.93	1.11	1.29	1.46
	r	0.87	0.87	0.86	0.86	0.85	0.85	0.84	1.04	1.04	1.03	1.03
	x	0.72	0.74	0.77	0.79	0.82	0.84	0.86	0.91	0.94	0.96	0.99
Axis Z-Z	Θ	28°42′	28°40′	28°35′	28°28′	28°20′	28°11′	28°0′	36°54′	36°53′	36°50′	36°46′
	I	0.70	0.85	1.01	1.15	1.30	1.44	1.58	1.15	1.36	1.57	1.77
	r	0.64	0.64	0.64	0.63	0.63	0.63	0.63	0.72	0.72	0.71	0.71

Size	Legs	4 x 4								
	t	¼	5/16	⅜	7/16	½	9/16	⅝	11/16	¾
Wt.		2.35	2.91	3.46	4.01	4.54	5.07	5.58	6.09	6.58
Area		1.94	2.41	2.86	3.31	3.75	4.19	4.61	5.03	5.44
f_1		⅜	⅜	⅜	⅜	⅜	⅜	⅜	⅜	⅜
f_2		¼	¼	¼	¼	¼	¼	¼	¼	¼
Axis X-X	I	2.94	3.61	4.26	4.87	5.46	6.02	6.56	7.08	7.57
	S	1.00	1.24	1.48	1.71	1.93	2.15	2.36	2.57	2.77
	r	1.23	1.23	1.22	1.21	1.21	1.20	1.19	1.19	1.18
	y	1.07	1.10	1.12	1.15	1.17	1.20	1.22	1.24	1.26
Axis Y-Y	I	2.94	3.61	4.26	4.87	5.46	6.02	6.56	7.08	7.57
	S	1.00	1.24	1.48	1.71	1.93	2.15	2.36	2.57	2.77
	r	1.23	1.23	1.22	1.21	1.21	1.20	1.19	1.19	1.18
	x	1.07	1.10	1.12	1.15	1.17	1.20	1.22	1.24	1.26
Axis Z-Z	Θ	45° 0′	45° 0′	45° 0′	45° 0′	45° 0′	45° 0′	45° 0′	45° 0′	45° 0′
	I	1.21	1.48	1.75	2.01	2.26	2.51	2.76	3.00	3.25
	r	0.79	0.78	0.78	0.78	0.78	0.77	0.77	0.77	0.77

ANGLES

ELEMENTS OF SECTIONS

All Dimensions in inches.
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Area in square inches.
I = Moment of Inertia in in.^{4}
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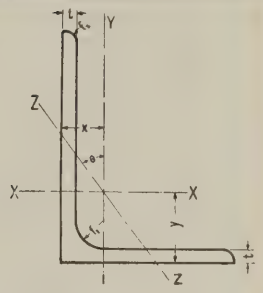
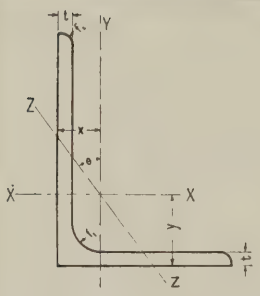


Size	Legs	4½ x 3				5x2½	5 x 3					
	t	5/16	3/8	7/16	1/2	1/2	5/16	3/8	7/16	1/2	9/16	5/8
	Wt.	2.70	3.22	3.72	4.22	4.24	2.89	3.45	3.99	4.52	5.05	5.56
	Area	2.23	2.66	3.08	3.49	3.50	2.39	2.85	3.30	3.74	4.17	4.60
	f_1	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
	f_2	5/16	5/16	5/16	5/16	1/4	5/16	5/16	5/16	5/16	5/16	5/16
Axis X-X	I	4.50	5.32	6.11	6.86	8.74	6.04	7.15	8.22	9.24	10.23	11.17
	S	1.47	1.75	2.03	2.30	2.77	1.80	2.15	2.49	2.83	3.15	3.47
	r	1.42	1.41	1 41	1.40	1.58	1.59	1.59	1.58	1.57	1.57	1.56
	y	1.44	1.46	1 49	1.52	1.84	1.65	1.68	1.70	1.73	1.76	1.78
Axis Y-Y	I	1.59	1.88	2.15	2.41	1.46	1.64	1.93	2.21	2.48	2.73	2.97
	S	0.69	0.83	0.96	1.08	0.77	0.70	0.84	0.97	1.10	1.22	1.34
	r	0.84	0.84	0.84	0.83	0.64	0.83	0.82	0.82	0.81	0.81	0.80
	x	0.70	0.72	0.75	0.77	0.60	0.66	0.69	0.71	0.74	0.76	0.79
Axis Z-Z	Θ	23°28′	23°25′	23°19′	23°11′	14°12′	19°44′	19°40′	19°34′	19°26′	19°17′	19°06′
	I	0.92	1.09	1.25	1.41	0.96	0.99	1.17	1.34	1.52	1.68	1.85
	r	0.64	0.64	0.64	0.64	0.52	0.64	0.64	0.64	0.64	0.64	0.63

Size	Legs	5 x 3½						5 x 4				
	t	5/16	3/8	7/16	1/2	9/16	5/8	3/8	7/16	1/2	9/16	5/8
	Wt.	3.09	3.69	4.27	4.84	5.40	5.95	3.91	4.53	5.14	5.74	6.33
	Area	2.56	3.05	3.53	4.00	4.46	4.92	3.23	3.75	4.25	4.75	5.23
	f_1	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16
	f_2	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16
Axis X-X	I	6.39	7.56	8.69	9.77	10.82	11.82	7.91	9.09	10.23	11.33	12.38
	S	1.85	2.21	2.56	2.90	3.24	3.56	2.26	2.62	2.97	3.31	3.64
	r	1.58	1.58	1.57	1.56	1.56	1.55	1.56	1.56	1.55	1.55	1.54
	y	1.55	1.58	1.61	1.63	1.66	1.68	1.50	1.53	1.55	1.58	1.60
Axis Y-Y	I	2.58	3.04	3.49	3.91	4.32	4.70	4.49	5.15	5.78	6.39	6.97
	S	0.96	1.15	1.33	1.50	1.67	1.84	1.50	1.74	1.97	2.19	2.41
	r	1.00	1.00	0.99	0.99	0.98	0.98	1.18	1.17	1.17	1.16	1.15
	x	0.81	0.84	0.87	0.89	0.92	0.94	1.01	1.03	1.06	1.08	1.11
Axis Z-Z	Θ	25°33′	25°32′	25°27′	25°22′	25°15′	25°07′	31°58′	31°56′	31°52′	31°47′	31°44′
	I	1.45	1.71	1.97	2.22	2.46	2.70	2.30	2.65	2.99	3.32	3.64
	r	0.75	0.75	0.75	0.74	0.74	0.74	0.84	0.84	0.84	0.84	0.83



ANGLES

ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I = Moment of Inertia in in.^{4}
S = Section Modulus in in.^{3}
r = Radius of Gyration in inches.

Size	Legs	5 x 5						
	t	3/8	7/16	1/2	9/16	5/8	11/16	3/4
Wt.		4.36	5.05	5.74	6.42	7.08	7.74	8.39
Area		3.60	4.18	4.74	5.30	5.85	6.40	6.93
f_1		1/2	1/2	1/2	1/2	1/2	1/2	1/2
f_2		3/8	3/8	3/8	3/8	3/8	3/8	3/8
Axis X-X	I	8.37	9.65	10.89	12.08	13.22	14.33	15.39
	S	2.30	2.67	3.03	3.39	3.73	4.07	4.41
	r	1.52	1.52	1.52	1.51	1.50	1.50	1.49
	y	1.36	1.38	1.41	1.43	1.46	1.48	1.51
Axis Y-Y	I	8.37	9.65	10.89	12.08	13.22	14.33	15.39
	S	2.30	2.67	3.03	3.39	3.73	4.07	4.41
	r	1.52	1.52	1.52	1.51	1.50	1.50	1.49
	x	1.36	1.38	1.41	1.43	1.46	1.48	1.51
Axis Z-Z	Θ	45°0′	45°0′	45°0′	45°0′	45°0′	45°0′	45°0′
	I	3.44	3.96	4.47	4.97	5.47	5.96	6.44
	r	0.98	0.97	0.97	0.97	0.97	0.97	0.96

Size	Legs	6 x 3½							
	t	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4
Wt.		3.49	4.15	4.81	5.46	6.10	6.73	7.35	7.95
Area		2.88	3.43	3.98	4.51	5.04	5.56	6.07	6.57
f_1		1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
f_2		5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16
Axis X-X	I	10.64	12.60	14.50	16.34	18.11	19.83	21.49	23.09
	S	2.64	3.15	3.65	4.14	4.62	5.09	5.56	6.01
	r	1.92	1.92	1.91	1.90	1.90	1.89	1.88	1.87
	y	1.97	2.00	2.03	2.06	2.08	2.11	2.13	2.16
Axis Y-Y	I	2.70	3.19	3.66	4.11	4.53	4.94	5.33	5.71
	S	0.98	1.17	1.35	1.53	1.71	1.88	2.05	2.21
	r	0.97	0.96	0.96	0.95	0.95	0.94	0.94	0.93
	x	0.74	0.77	0.80	0.82	0.85	0.87	0.89	0.92
Axis Z-Z	Θ	18° 52′	18° 51′	18° 47′	18° 42′	18° 35′	18° 28′	18° 20′	18° 11′
	I	1.65	1.95	2.24	2.52	2.80	3.07	3.34	3.61
	r	0.76	0.75	0.75	0.75	0.75	0.74	0.74	0.74

ANGLES

ELEMENTS OF SECTIONS

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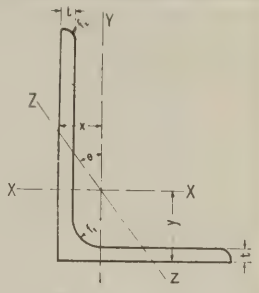
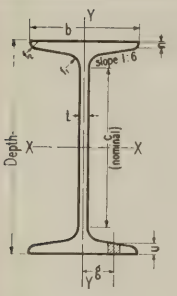


Size	Legs	6 x 4						
	t	3/8	7/16	1/2	9/16	5/8	11/16	3/4
	Wt.	4.36	5.05	5.74	6.42	7.08	7.74	8.39
	Area	3.60	4.18	4.74	5.30	5.85	6.40	6.93
	f_1	1/2	1/2	1/2	1/2	1/2	1/2	1/2
	f_2	3/8	3/8	3/8	3/8	3/8	3/8	3/8
Axis X-X	I	13.02	15.02	16.95	18.82	20.63	22.39	24.08
	S	3.17	3.69	4.19	4.69	5.17	5.64	6.11
	r	1.90	1.90	1.89	1.88	1.88	1.87	1.86
	y	1.90	1.93	1.96	1.98	2.01	2.03	2.06
Axis Y-Y	I	4.63	5.34	6.01	6.65	7.27	7.86	8.43
	S	1.50	1.74	1.98	2.21	2.44	2.66	2.87
	r	1.13	1.13	1.13	1.12	1.11	1.11	1.10
	x	0.91	0.94	0.97	0.99	1.02	1.04	1.07
Axis Z-Z	Θ	23°33′	23°31′	23°27′	23°22′	23°16′	23°10′	23°02′
	I	2.67	3.07	3.47	3.86	4.24	4.61	4.98
	r	0.86	0.86	0.86	0.85	0.85	0.85	0.85

Size	Legs	6 x 6						
	t	3/8	7/16	1/2	9/16	5/8	11/16	3/4
	Wt.	5.27	6.11	6.95	7.78	8.59	9.40	10.20
	Area	4.35	5.05	5.74	6.43	7.10	7.77	8.43
	f_1	1/2	1/2	1/2	1/2	1/2	1/2	1/2
	f_2	3/8	3/8	3/8	3/8	3/8	3/8	3/8
Axis X-X	I	14.85	17.15	19.38	21.54	23.64	25.67	27.64
	S	3.38	3.93	4.46	4.99	5.51	6.02	6.52
	r	1.85	1.84	1.84	1.83	1.82	1.82	1.81
	y	1.60	1.63	1.66	1.68	1.71	1.73	1.76
Axis Y-Y	I	14.85	17.15	19.38	21.54	23.64	25.67	27.64
	S	3.38	3.93	4.46	4.99	5.51	6.02	6.52
	r	1.85	1.84	1.84	1.83	1.82	1.82	1.81
	x	1.60	1.63	1.66	1.68	1.71	1.73	1.76
Axis Z-Z	Θ	45°0′	45°0′	45°0′	45°0′	45°0′	45°0′	45°0′
	I	6.07	7.01	7.92	8.82	9.70	10.57	11.43
	r	1.18	1.18	1.17	1.17	1.17	1.17	1.16



I-BEAMS

ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I = Moment of Inertia in in.^{4}
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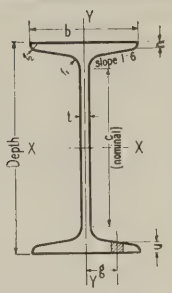
r = Radius of Gyration in inches.
Rivet given is maximum allowable in flange.
g = Usual gage.
u = Nominal grip.

Size	Depth	3			4				5		
	t	0.170	0.251	0.349	0.190	0.253	0.326	0.400	0.210	0.347	0.494
	b	2.330	2.411	2.509	2.660	2.723	2.796	2.870	3.000	3.137	3.284
	Wt.	2.02	2.31	2.67	2.72	3.03	3.38	3.74	3.53	4.36	5.25
	Area	1.67	1.91	2.21	2.25	2.50	2.79	3.09	2.92	3.60	4.34
	n	0.170	0.170	0.170	0.190	0.190	0.190	0.190	0.210	0.210	0.210
	f_1	0.27	0.27	0.27	0.29	0.29	0.29	0.29	0.31	0.31	0.31
	f_2	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.13	0.13	0.13
	c	1¾	1¾	1¾	2¾	2¾	2¾	2¾	3½	3½	3½
Axis X-X	I	2.52	2.71	2.93	6.06	6.40	6.79	7.18	12.26	13.69	15.22
	S	1.68	1.80	1.95	3.03	3.20	3.39	3.59	4.90	5.48	6.09
	r	1.23	1.19	1.15	1.64	1.60	1.56	1.52	2.05	1.95	1.87
Axis Y-Y	I	0.46	0.51	0.59	0.76	0.82	0.90	0.99	1.21	1.41	1.66
	S	0.39	0.42	0.47	0.57	0.61	0.65	0.69	0.81	0.90	1.01
	r	0.52	0.52	0.52	0.58	0.57	0.57	0.57	0.64	0.63	0.62
Rivet Data	Diam.	⅜	⅜	⅜	½	½	½	½	½	½	½
	g	¾	¾	¾	¾	¾	¾	¾	⅞	⅞	⅞
	u	5/16	5/16	5/16	5/16	5/16	5/16	5/16	⅜	⅜	⅜

Size	Depth	6			7			8			
	t	0.230	0.343	0.465	0.250	0.345	0.450	0.270	0.349	0.441	0.532
	b	3.330	3.443	3.565	3.660	3.755	3.860	4.000	4.079	4.171	4.262
	Wt.	4.43	5.25	6.13	5.42	6.23	7.12	6.53	7.30	8.19	9.07
	Area	3.66	4.34	5.07	4.48	5.15	5.88	5.40	6.03	6.77	7.49
	n	0.230	0.230	0.230	0.250	0.250	0.250	0.270	0.270	0.270	0.270
	f_1	0.33	0.33	0.33	0.35	0.35	0.35	0.37	0.37	0.37	0.37
	f_2	0.14	0.14	0.14	0.15	0.15	0.15	0.16	0.16	0.16	0.16
	c	4½	4½	4½	5¼	5¼	5¼	6¼	6¼	6¼	6¼
Axis X-X	I	22.08	24.11	26.31	36.69	39.40	42.40	57.55	60.92	64.85	68.73
	S	7.36	8.04	8.77	10.48	11.26	12.12	14.39	15.23	16.21	17.18
	r	2.46	2.36	2.28	2.86	2.77	2.69	3.27	3.18	3.10	3.03
Axis Y-Y	I	1.82	2.04	2.31	2.63	2.88	3.17	3.73	3.99	4.31	4.66
	S	1.09	1.19	1.30	1.44	1.53	1.64	1.86	1.95	2.07	2.19
	r	0.71	0.69	0.68	0.77	0.75	0.73	0.83	0.81	0.80	0.79
Rivet Data	Diam.	⅝	⅝	⅝	⅝	⅝	⅝	¾	¾	¾	¾
	g	1	1	1	1⅛	1⅛	1⅛	1⅛	1⅛	1⅛	1⅛
	u	⅜	⅜	⅜	⅜	⅜	⅜	7/16	7/16	7/16	½

I-BEAMS

ELEMENTS OF SECTIONS



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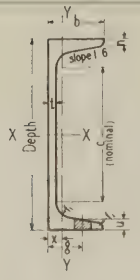
g = Usual gage.
u = Nominal grip.

Size	Depth	9			10			12				
	t	0.290	0.397	0.561	0.310	0.447	0.594	0.350	0.428	0.460	0.565	0.687
	b	4.330	4.437	4.601	4.660	4.797	4.944	5.000	5.078	5.250	5.355	5.477
	Wt.	7.72	8.89	10.68	9.01	10.67	12.45	11.31	12.44	14.49	16.01	17.78
	Area	6.38	7.35	8.82	7.45	8.82	10.29	9.35	10.28	11.97	13.23	14.70
	n	0.290	0.290	0.290	0.310	0.310	0.310	0.350	0.350	0.460	0.460	0.460
	f_1	0.39	0.39	0.39	0.41	0.41	0.41	0.45	0.45	0.56	0.56	0.56
	f_2	0.17	0.17	0.17	0.19	0.19	0.19	0.21	0.21	0.28	0.28	0.28
	c	7	7	7	8	8	8	9¾	9¾	9¼	9¼	9¼
Axis X-X	I	85.90	92.40	102.36	123.39	134.81	147.06	218.13	229.36	272.15	287.27	304.84
	S	19.09	20.53	22.75	24.68	26.96	29.41	36.35	38.23	45.36	47.88	50.81
	r	3.67	3.55	3.41	4.07	3.91	3.78	4.83	4.72	4.77	4.66	4.56
Axis Y-Y	I	5.09	5.54	6.30	6.78	7.50	8.36	9.35	9.87	13.54	14.50	15.71
	S	2.35	2.50	2.74	2.91	3.13	3.38	3.74	3.89	5.16	5.42	5.74
	r	0.89	0.87	0.85	0.95	0.92	0.90	1.00	0.98	1.06	1.05	1.03
Rivet Data	Diam.	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾
	g	1¼	1¼	1¼	1⅜	1⅜	1⅜	1½	1½	1½	1½	1¾
	u	½	½	½	½	½	½	9/16	9/16	¾	¾	¾



CHANNELS

ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I = Moment of Inertia in in.^{4}
S = Section Modulus in in.^{3}
r = Radius of Gyration in inches.
Rivet given is maximum allowable in flange.
g = Usual gage.
u = Nominal grip.

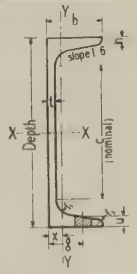
Size	Depth	3			4			5		
	t	0.170	0.258	0.356	0.180	0.247	0.320	0.190	0.325	0.472
	b	1.410	1.498	1.596	1.580	1.647	1.720	1.750	1.885	2.032
	Wt.	1.46	1.78	2.13	1.90	2.22	2.58	2.38	3.20	4.09
	Area	1.21	1.47	1.76	1.57	1.84	2.13	1.97	2.64	3.38
	n	0.170	0.170	0.170	0.180	0.180	0.180	0.190	0.190	0.190
	f_1	0.27	0.27	0.27	0.28	0.28	0.28	0.29	0.29	0.29
	f_2	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11
	c	1¾	1¾	1¾	2¾	2¾	2¾	3¾	3¾	3¾
Axis X-X	I	1.66	1.85	2.07	3.83	4.19	4.58	7.49	8.90	10.43
	S	1.10	1.24	1.38	1.92	2.10	2.29	3.00	3.56	4.17
	r	1.17	1.12	1.08	1.56	1.51	1.47	1.95	1.83	1.76
Axis Y-Y	I	0.20	0.25	0.31	0.32	0.37	0.43	0.48	0.63	0.81
	S	0.20	0.23	0.27	0.28	0.31	0.34	0.38	0.45	0.53
	r	0.40	0.41	0.42	0.45	0.45	0.45	0.49	0.49	0.49
	x	0.44	0.44	0.46	0.46	0.45	0.46	0.48	0.48	0.51
Rivet Data	Diam.	½	½	½	½	½	½	½	½	½
	g	⅞	⅞	⅞	1	1	1	1⅛	1⅛	1⅛
	u	¼	¼	¼	5/16	5/16	5/16	5/16	5/16	5/16

Size	Depth	6				7				
	t	0.200	0.314	0.437	0.559	0.210	0.314	0.419	0.524	0.629
	b	1.920	2.034	2.157	2.279	2.090	2.194	2.299	2.404	2.509
	Wt.	2.91	3.73	4.63	5.51	3.47	4.36	5.24	6.13	7.02
	Area	2.40	3.09	3.82	4.56	2.87	3.60	4.33	5.07	5.80
	n	0.200	0.200	0.200	0.200	0.210	0.210	0.210	0.210	0.210
	f_1	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.31	0.31
	f_2	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13
	c	4½	4½	4½	4½	5½	5½	5½	5½	5½
Axis X-X	I	13.12	15.18	17.39	19.59	21.27	24.24	27.24	30.25	33.25
	S	4.37	5.06	5.80	6.53	6.08	6.93	7.78	8.64	9.50
	r	2.34	2.22	2.13	2.07	2.72	2.60	2.51	2.44	2.39
Axis Y-Y	I	0.69	0.87	1.05	1.26	0.97	1.17	1.38	1.59	1.83
	S	0.49	0.56	0.64	0.73	0.63	0.70	0.78	0.86	0.95
	r	0.54	0.53	0.52	0.53	0.58	0.57	0.56	0.56	0.56
	x	0.51	0.50	0.51	0.54	0.54	0.52	0.53	0.55	0.58
Rivet Data	Diam.	⅝	⅝	⅝	⅝	⅝	⅝	⅝	⅝	⅝
	g	1⅛	1⅛	1⅜	1⅜	1¼	1¼	1¼	1½	1½
	u	5/16	⅜	⅜	⅜	⅜	⅜	7/16	7/16	7/16

CHANNELS

ELEMENTS OF SECTIONS

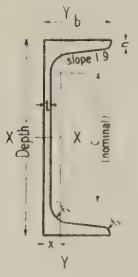
All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I = Moment of Inertia in in.^{4}
S = Section Modulus in in.^{3}
r = Radius of Gyration in inches.
Rivet given is maximum allowable in flange.
g = Usual gage.
u = Nominal grip.



Size	Depth	8					9			
	t	0.220	0.303	0.395	0.487	0.579	0.230	0.285	0.448	0.612
	b	2.260	2.343	2.435	2.527	2.619	2.430	2.485	2.648	2.812
	Wt.	4.08	4.89	5.78	6.67	7.56	4.74	5.34	7.11	8 90
	Area	3.38	4.04	4.78	5.51	6.25	3.91	4.41	5.88	7.35
	n	0.220	0.220	0.220	0.220	0.220	0.230	0.230	0.230	0.230
	f_1	0.32	0.32	0.32	0.32	0.32	0.33	0.33	0.33	0.33
	f_2	0.13	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14
	c	6¼	6¼	6¼	6¼	6¼	7¼	7¼	7¼	7¼
Axis X-X	I	32.57	36.11	40.04	43.96	47.89	47.68	51.02	60.92	70 89
	S	8.14	9.03	10.01	10.99	11 97	10 60	11.34	13.54	15.75
	r	3.11	2.99	2.90	2.82	2.77	3.49	3.40	3.22	3.11
Axis Y-Y	I	1.32	1.53	1.75	1.98	2.22	1.75	1.93	2.42	2.94
	S	0.78	0.85	0.93	1.01	1.09	0.96	1.01	1.17	1.34
	r	0.63	0.61	0.61	0.60	0.60	0.67	0.66	0.64	0.63
	x	0.57	0 55	0.55	0.57	0.59	0 60	0.59	0.58	0.61
Rivet Data	Diam.	¾	¾	¾	¾	¾	¾	¾	¾	¾
	g	1⅜	1⅜	1½	1½	1½	1⅜	1⅜	1½	1½
	u	⅜	⅜	7/16	7/16	7/16	7/16	7/16	½	½

Size	Depth	10				12			
	t	0.240	0.379	0.526	0.673	0.280	0.387	0.510	0.632
	b	2.600	2.739	2.886	3.033	2.940	3.047	3.170	32.92
	Wt.	5.43	7.11	8.89	10.67	7.33	8.89	10.67	12.45
	Area	4.49	5.88	7.35	8.82	6.06	7.35	8.82	10.29
	n	0.240	0.240	0.240	0.240	0.280	0.280	0.280	0.280
	f_1	0.34	0.34	0.34	0.34	0.38	0.38	0.38	0.38
	f_2	0.14	0.14	0.14	0.14	0.17	0.17	0.17	0.17
	c	8¼	8¼	8¼	8¼	10	10	10	10
Axis X-X	I	67.37	78.95	91.20	103.45	128.96	144.37	162.08	179.65
	S	13.47	15.79	18.24	20.69	21.49	24.06	27.01	29.94
	r	3.87	3.66	3.52	3.43	4.61	4.43	4.29	4.18
Axis Y-Y	I	2.28	2.81	3.36	3.95	3.87	4.47	5.14	5.82
	S	1.16	1.32	1.48	1.66	1.73	1 89	2 06	2 24
	r	0.71	0.69	0.68	0.67	0.80	0 78	0 76	0 75
	x	0.63	0.61	0.62	0.65	0.70	0 67	0.67	0.69
Rivet Data	Diam.	¾	¾	¾	¾	⅞	⅞	⅞	⅞
	g	1½	1½	1¾	1¾	1¾	1¾	1¾	2
	u	7/16	7/16	½	½	½	½	½	⅝

CAR CHANNELS



ELEMENTS OF SECTIONS

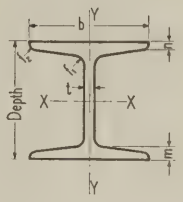
All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I = Moment of Inertia in in.^{4}
S = Section Modulus in in.^{3}
r = Radius of Gyration in inches.

Size	Depth	10		
	t	0.375	0.438	0.500
	b	3.500	3.563	3.625
	Wt.	8.84	9.59	10.34
	Area	7.30	7.93	8.55
	n	0.375	0.375	0.375
	f_1	0.625	0.625	0.625
	f_2	0.188	0.188	0.188
	c	7½	7½	7½
Axis X-X	I	109.62	114.87	120.03
	S	21.92	22.97	24.01
	r	3.88	3.81	3.75
Axis Y-Y	I	7.19	7.73	8.25
	S	2.80	2.93	3.04
	r	0.99	0.99	0.98
	x	0.93	0.92	0.91

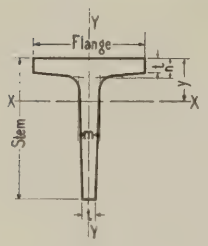
H-BEAMS

ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I = Moment of Inertia in in.^{4}
S = Section Modulus in in.^{3}
r = Radius of Gyration in inches.



Size	Depth	4	5	6			8		
	t	0.313	0.313	0.250	0.313	0.438	0.313	0.375	0.500
	b	4.000	5.000	5.938	6.000	6.125	7.938	8.000	8.125
	Wt.	4.85	6.63	8.04	8.49	9.40	11.51	12.11	13.32
	Area	4.00	5.48	6.64	7.02	7.77	9.52	10.01	11.01
	n	0.290	0.330	0.360	0.360	0.360	0.358	0.358	0.358
	m	0.453	0.503	0.542	0.542	0.542	0.560	0.560	0.560
	f_1	0.313	0.313	0.313	0.313	0.313	0.313	0.313	0.313
	f_2	0.145	0.165	0.180	0.180	0.180	0.179	0.179	0.179
Axis X-X	I	10.72	23.82	44.06	45.19	47.44	112.94	115.58	120.92
	S	5.36	9.53	14.69	15.06	15.81	28.23	28.90	30.23
	r	1.64	2.08	2.58	2.54	2.47	3.45	3.40	3.31
Axis Y-Y	I	3.56	7.82	14.18	14.65	15.65	34.15	35.01	36.79
	S	1.78	3.13	4.77	4.88	5.11	8.60	8.75	9.06
	r	0.94	1.19	1.46	1.44	1.42	1.89	1.87	1.83



TEES

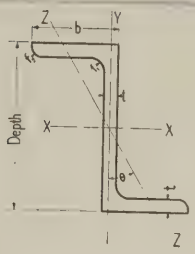
ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I =Moment of Inertia in in.^{4}
S =Section Modulus in in.^{3}
r =Radius of Gyration in inches.

Size														
	Flange	1	1½			2		2½				3		
	Stem	1	1¼	1½	2	2	2	1¼	2½	2½	3	2½	3	3
	t	⅛	⅛	¼	3/16	¼	5/16	3/16	5/16	3/8	5/16	5/16	5/16	3/8
Wt.		0.32	0.45	0.89	0.88	1.29	1.55	1.03	1.97	2.29	2.17	2.19	2.40	2.79
Area		0.27	0.37	0.74	0.73	1.07	1.28	0.85	1.62	1.89	1.80	1.81	1.98	2.31
m		5/32	5/32	9/32	¼	5/16	3/8	5/16	3/8	7/16	3/8	3/8	3/8	7/16
n		5/32	5/32	9/32	¼	5/16	3/8	9/32	3/8	7/16	3/8	3/8	3/8	7/16
f		⅛	⅛	3/16	3/16	¼	¼	3/16	¼	¼	¼	5/16	5/16	5/16
Axis X-X	I	0.02	0.05	0.14	0.27	0.37	0.43	0.08	0.89	1.02	1.49	0.94	1.58	1.83
	S	0.03	0.05	0.14	0.20	0.26	0.31	0.09	0.50	0.58	0.72	0.51	0.74	0.86
	r	0.29	0.36	0.44	0.61	0.59	0.58	0.31	0.74	0.73	0.91	0.72	0.89	0.89
	y	0.29	0.33	0.46	0.62	0.58	0.61	0.30	0.73	0.76	0.92	0.68	0.85	0.88
Axis Y-Y	I	0.01	0.04	0.08	0.06	0.18	0.23	0.28	0.44	0.53	0.44	0.75	0.75	0.90
	S	0 02	0.05	0.10	0.08	0.18	0.23	0.22	0.35	0.42	0.35	0.50	0.50	0.60
	r	0.21	0.32	0.32	0.29	0.41	0.42	0.57	0.52	0.53	0.50	0.65	0.62	0.63

Size													
	Flange	4										5	6½
	Stem	2½	2½	3	3	4	4	4½	4½	5	5	3	6½
	t	5/16	3/8	5/16	3/8	3/8	½	3/8	½	3/8	½	3/8	0.4
Wt.		2.63	3.06	2.84	3.31	3.85	4.92	4.10	5.24	4.34	5.56	4.14	7.09
Area		2.17	2.53	2.34	2.73	3.18	4.07	3.39	4.33	3.59	4.60	3.42	5.86
m		3/8	7/16	3/8	7/16	7/16	9/16	7/16	9/16	7/16	9/16	5/8	0.45
n		3/8	7/16	3/8	7/16	7/16	9/16	7/16	9/16	7/16	9/16	7/16	0.55
f		3/8	3/8	3/8	3/8	½	½	½	½	½	½	3/8	0.40
Axis X-X	I	1.01	1.17	1.72	1.99	4.56	5.74	6.37	8.04	8.56	10.84	2.37	23.57
	S	0.53	0.62	0.77	0.89	1.58	2.02	1.98	2.55	2.43	3.14	1.06	4.96
	r	0.68	0.68	0.86	0.85	1.20	1.19	1.37	1.36	1.54	1.54	0.83	2.01
	y	0.60	0.62	0.75	0.78	1.11	1.17	1.29	1.35	1.48	1.54	0.76	1.75
Axis Y-Y	I	1.77	2.11	1.77	2.11	2.12	2.82	2.13	2.83	2.13	2.83	4.13	9.51
	S	0.88	1.05	0.89	1.06	1.06	1.41	1.06	1.41	1.06	1.42	1.65	2.92
	r	0.90	0.91	0.87	0.88	0.82	0.83	0.79	0.81	0.77	0.79	1.10	1.27

ZEES

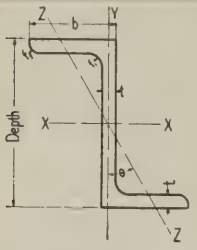


ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I = Moment of Inertia in in.^{4}
S = Section Modulus in in.^{3}
r = Radius of Gyration in inches.

Size	Nominal Depth	3					
	t	1/4	5/16	3/8	7/16	1/2	9/16
	Actual Depth	3	3 1/16	3	3 1/16	3	3 1/16
	b	2 11/16	2 3/4	2 11/16	2 3/4	2 11/16	2 3/4
	Wt.	2.40	3.02	3.48	4.09	4.48	5.08
	Area	1.98	2.50	2.87	3.38	3.70	4.20
	f_1	5/16	5/16	5/16	5/16	5/16	5/16
	f_2	1/4	1/4	1/4	1/4	1/4	1/4
Axis X-X	I	2.89	3.65	3.86	4.57	4.60	5.26
	S	1.92	2.39	2.57	2. 9	3.06	3.44
	r	1.21	1.21	1.16	1.16	1 11	1.12
Axis Y-Y	I	2.64	3 47	3.76	4.59	4.71	5.53
	S	1.03	1.34	1.50	1.81	1.93	2.24
	r	1.15	1.18	1.14	1.17	1.13	1.15
AxisZ-Z	Θ	43°24′	44°05′	44°31′	45°04′	45°27′	45°55′
	I	0.59	0.76	0.82	0.99	1.03	1.22
	r	0.54	0.55	0.53	0.54	0.53	0.54

Size	Nominal Depth	4					
	t	1/4	5/16	3/8	7/16	1/2	9/16
	Actual Depth	4	4 1/16	4 1/8	4	4 1/16	4 1/8
	b	3 1/16	3 1/8	3 3/16	3 1/16	3 1/8	3 3/16
	Wt.	2.93	3.68	4.44	4.92	5.65	6.40
	Area	2.42	3.04	3.67	4.06	4.67	5.29
	f_1	5/16	5/16	5/16	5/16	5/16	5/16
	f_2	1/4	1/4	1/4	1/4	1/4	1/4
Axis X-X	I	6.32	7.97	9.66	9.68	11.20	12.76
	S	3.16	3.92	4.68	4.84	5.51	6.19
	r	1.62	1.62	1.62	1.54	1.55	1.55
Axis Y-Y	I	4.01	5.24	6.54	6.53	7.75	9.05
	S	1.36	1.76	2.18	2.30	2.70	3.11
	r	1.29	1.31	1.33	1.27	1.29	1.31
AxisZ-Z	Θ	36°47′	37°24′	37°55′	37°50′	38°16′	38°41′
	I	1.08	1.39	1.72	1.74	2.06	2.41
	r	0.67	0.68	0.68	0.66	0.66	0.68



ZEES

ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I = Moment of Inertia in in.^{4}
S = Section Modulus in in.^{3}
r = Radius of Gyration in inches.

Size	Nominal Depth	5					
	t	5/16	3/8	7/16	1/2	9/16	5/8
	Actual Depth	5	5 1/16	5 1/8	5	5 1/16	5 1/8
	b	3 1/4	3 5/16	3 3/8	3 1/4	3 5/16	3 3/8
	Wt.	4.13	4.98	5.84	6.37	7.21	8.05
	Area	3.41	4.12	4.83	5.27	5.96	6.66
	f_1	5/16	5/16	5/16	5/16	5/16	5/16
	f_2	1/4	1/4	1/4	1/4	1/4	1/4
Axis X-X	I	13.41	16.23	19.12	19.23	21.87	24.56
	S	5.36	6.41	7.46	7.69	8.64	9.59
	r	1.98	1.99	1.99	1.91	1.92	1.92
Axis Y-Y	I	5.94	7.40	8.95	8.82	10.28	11.82
	S	1.92	2.37	2.84	2.94	3.39	3.86
	r	1.32	1.34	1.36	1.29	1.31	1.33
Axis Z-Z	Θ	30°40′	31°08′	31°32′	31°09′	31°32′	31°53′
	I	1.89	2.33	2.81	2.82	3.29	3.79
	r	0.74	0.75	0.76	0.73	0.74	0.75

Size	Nominal Depth	6					
	t	3/8	7/16	1/2	9/16	5/8	11/16
	Actual Depth	6	6 1/16	6 1/8	6	6 1/16	6 1/8
	b	3 1/2	3 9/16	3 5/8	3 1/2	3 9/16	3 5/8
	Wt.	5.58	6.54	7.51	8.10	9.05	10.00
	Area	4.61	5.40	6.20	6.69	7.48	8.27
	f_1	5/16	5/16	5/16	5/16	5/16	5/16
	f_2	1/4	1/4	1/4	1/4	1/4	1/4
Axis X-X	I	25.40	29.88	34.44	34.71	38.93	43.24
	S	8.47	9.86	11.24	11.57	12.84	14.12
	r	2.35	2.35	2.36	2.28	2.28	2.29
Axis Y-Y	I	8.83	10.66	12.58	12.32	14.15	16.07
	S	2.67	3.19	3.73	3.83	4.35	4.90
	r	1.38	1.40	1.42	1.36	1.38	1.39
Axis Z-Z	Θ	26°55′	27°17′	27°37′	27°08′	27°26′	27°44′
	I	3.08	3.70	4.36	4.36	5.01	5.70
	r	0.82	0.83	0.84	0.81	0.82	0.83

TABLE 10

AREAS AND WEIGHTS OF RECTANGULAR SECTIONS

Upper Value is Area in Square Inches—Lower Value is Weight in Pounds per Lineal Foot

THICKNESS, inches	Width inches: 1/8	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4
1/32	0.004 0.005	0.008 0.010	0.016 0.019	0.023 0.028	0.031 0.038	0.039 0.047	0.047 0.057	0.055 0.066	0.063 0.076	0.070 0.085	0.078 0.095	0.086 0.104
1/16	0.008 0.010	0.016 0.019	0.031 0.038	0.047 0.057	0.063 0.076	0.078 0.095	0.094 0.113	0.109 0.132	0.125 0.151	0.141 0.170	0.156 0.189	0.172 0.208
3/32	0.012 0.014	0.023 0.028	0.047 0.057	0.070 0.085	0.094 0.113	0.117 0.142	0.141 0.170	0.164 0.199	0.188 0.227	0.211 0.255	0.234 0.284	0.258 0.312
1/8	0.016 0.019	0.031 0.038	0.063 0.076	0.094 0.113	0.125 0.151	0.156 0.189	0.188 0.227	0.219 0.265	0.250 0.303	0.281 0.340	0.313 0.378	0.344 0.416
5/32	0.020 0.024	0.039 0.047	0.078 0.095	0.117 0.142	0.156 0.189	0.195 0.236	0.234 0.284	0.273 0.331	0.313 0.378	0.352 0.425	0.391 0.473	0.430 0.520
3/16	0.023 0.028	0.047 0.057	0.094 0.113	0.141 0.170	0.188 0.227	0.234 0.284	0.281 0.340	0.328 0.397	0.375 0.454	0.422 0.511	0.469 0.567	0.516 0.624
7/32	0.027 0.033	0.055 0.066	0.109 0.132	0.164 0.199	0.219 0.265	0.273 0.331	0.328 0.397	0.383 0.463	0.438 0.529	0.492 0.596	0.547 0.662	0.602 0.728
1/4	0.031 0.038	0.063 0.076	0.125 0.151	0.188 0.227	0.250 0.303	0.313 0.378	0.375 0.454	0.438 0.529	0.500 0.605	0.563 0.681	0.625 0.756	0.688 0.832
9/32	0.035 0.043	0.070 0.085	0.141 0.170	0.211 0.255	0.281 0.340	0.352 0.425	0.422 0.511	0.492 0.596	0.563 0.681	0.633 0.766	0.703 0.851	0.773 0.936
5/16	0.039 0.047	0.078 0.095	0.156 0.189	0.234 0.284	0.313 0.378	0.391 0.473	0.469 0.567	0.547 0.662	0.625 0.756	0.703 0.851	0.781 0.945	0.859 1.040
11/32	0.043 0.052	0.086 0.104	0.172 0.208	0.258 0.312	0.344 0.416	0.430 0.520	0.516 0.624	0.602 0.728	0.688 0.832	0.773 0.936	0.859 1.040	0.945 1.144
3/8	0.047 0.057	0.094 0.113	0.188 0.227	0.281 0.340	0.375 0.454	0.469 0.567	0.563 0.681	0.656 0.794	0.750 0.908	0.844 1.021	0.938 1.134	1.031 1.248
7/16	0.055 0.066	0.109 0.132	0.219 0.265	0.328 0.397	0.438 0.529	0.547 0.662	0.656 0.794	0.766 0.926	0.875 1.059	0.984 1.191	1.094 1.323	1.203 1.456
1/2	0.063 0.076	0.125 0.151	0.250 0.303	0.375 0.454	0.500 0.605	0.625 0.756	0.750 0.908	0.875 1.059	1.000 1.210	1.125 1.361	1.250 1.513	1.375 1.664
9/16	0.070 0.085	0.141 0.170	0.281 0.340	0.422 0.511	0.563 0.681	0.703 0.851	0.844 1.021	0.984 1.191	1.125 1.361	1.266 1.531	1.406 1.702	1.547 1.872
5/8	0.078 0.095	0.156 0.189	0.313 0.378	0.469 0.567	0.625 0.756	0.781 0.945	0.938 1.134	1.094 1.323	1.250 1.513	1.406 1.702	1.563 1.891	1.719 2.080
11/16	0.086 0.104	0.172 0.208	0.344 0.416	0.516 0.624	0.688 0.832	0.859 1.040	1.031 1.248	1.203 1.456	1.375 1.664	1.547 1.872	1.719 2.080	1.891 2.288
3/4	0.094 0.113	0.188 0.227	0.375 0.454	0.563 0.681	0.750 0.908	0.938 1.134	1.125 1.361	1.313 1.588	1.500 1.815	1.688 2.042	1.875 2.269	2.063 2.496

TABLE 10—*Continued*

AREAS AND WEIGHTS OF RECTANGULAR SECTIONS

Upper Value is Area in Square Inches—Lower Value is Weight in Pounds per Lineal Foot

THICKNESS, inches	Width inches: 3	3¼	3½	3¾	4	4¼	4½	4¾	5	5¼	5½	5¾
1/32	0.094 0.113	0.102 0.123	0.109 0.132	0.117 0.142	0.125 0.151	0.133 0.161	0.141 0.170	0.148 0.180	0.156 0.189	0.164 0.199	0.172 0.208	0.180 0.217
1/16	0.188 0.227	0.203 0.246	0.219 0.265	0.234 0.284	0.250 0.303	0.266 0.321	0.281 0.340	0.297 0.359	0.313 0.378	0.328 0.397	0.344 0.416	0.359 0.435
3/32	0.281 0.340	0.305 0.369	0.328 0.397	0.352 0.425	0.375 0.454	0.398 0.482	0.422 0.511	0.445 0.539	0.469 0.567	0.492 0.596	0.516 0.624	0.539 0.652
1/8	0.375 0.454	0.406 0.492	0.438 0.529	0.469 0.567	0.500 0.605	0.531 0.643	0.563 0.681	0.594 0.718	0.625 0.756	0.656 0.794	0.688 0.832	0.719 0.870
5/32	0.469 0.567	0.508 0.615	0.547 0.662	0.586 0.709	0.625 0.756	0.664 0.804	0.703 0.851	0.742 0.898	0.781 0.945	0.820 0.993	0.859 1.040	0.898 1.087
3/16	0.563 0.681	0.609 0.737	0.656 0.794	0.703 0.851	0.750 0.908	0.797 0.964	0.844 1.021	0.891 1.078	0.938 1.134	0.984 1.191	1.031 1.248	1.078 1.305
7/32	0.656 0.794	0.711 0.860	0.766 0.926	0.820 0.993	0.875 1.059	0.930 1.125	0.984 1.191	1.039 1.257	1.094 1.323	1.148 1.390	1.203 1.456	1.258 1.522
1/4	0.750 0.908	0.813 0.983	0.875 1.059	0.938 1.134	1.000 1.210	1.063 1.286	1.125 1.361	1.188 1.437	1.250 1.513	1.313 1.588	1.375 1.664	1.438 1.739
9/32	0.844 1.021	0.914 1.106	0.984 1.191	1.055 1.276	1.125 1.361	1.195 1.446	1.266 1.531	1.336 1.617	1.406 1.702	1.477 1.787	1.547 1.872	1.617 1.957
5/16	0.938 1.134	1.016 1.229	1.094 1.323	1.172 1.418	1.250 1.513	1.328 1.607	1.406 1.702	1.484 1.796	1.563 1.891	1.641 1.985	1.719 2.080	1.797 2.174
11/32	1.031 1.248	1.117 1.352	1.203 1.456	1.289 1.560	1.375 1.664	1.461 1.768	1.547 1.872	1.633 1.976	1.719 2.080	1.805 2.184	1.891 2.288	1.977 2.392
3/8	1.125 1.361	1.219 1.475	1.313 1.588	1.406 1.702	1.500 1.815	1.594 1.928	1.688 2.042	1.781 2.155	1.875 2.269	1.969 2.382	2.063 2.496	2.156 2.609
7/16	1.313 1.588	1.422 1.721	1.531 1.853	1.641 1.985	1.750 2.118	1.859 2.250	1.969 2.382	2.078 2.515	2.188 2.647	2.297 2.779	2.406 2.912	2.516 3.044
1/2	1.500 1.815	1.625 1.966	1.750 2.118	1.875 2.269	2.000 2.420	2.125 2.571	2.250 2.723	2.375 2.874	2.500 3.025	2.625 3.176	2.750 3.328	2.875 3.479
9/16	1.688 2.042	1.828 2.212	1.969 2.382	2.109 2.552	2.250 2.723	2.391 2.893	2.531 3.063	2.672 3.233	2.813 3.403	2.953 3.573	3.094 3.743	3.234 3.914
5/8	1.875 2.269	2.031 2.458	2.188 2.647	2.344 2.836	2.500 3.025	2.656 3.214	2.813 3.403	2.969 3.592	3.125 3.781	3.281 3.970	3.438 4.159	3.594 4.348
11/16	2.063 2.496	2.234 2.704	2.406 2.912	2.578 3.120	2.750 3.328	2.922 3.536	3.094 3.743	3.266 3.951	3.438 4.159	3.609 4.367	3.781 4.575	3.953 4.783
3/4	2.250 2.723	2.438 2.949	2.625 3.176	2.813 3.403	3.000 3.630	3.188 3.857	3.375 4.084	3.563 4.311	3.750 4.538	3.938 4.764	4.125 4.991	4.313 5.218

TABLE 10—*Continued*

AREAS AND WEIGHTS OF RECTANGULAR SECTIONS

Upper Value is Area in Square Inches—Lower Value is Weight in Pounds per Lineal Foot

THICKNESS, inches	Width inches: 6	6¼	6½	6¾	7	7¼	7½	7¾	8	8¼	8½	8¾
1/32	0.188 0.227	0.195 0.236	0.203 0.246	0.211 0.255	0.219 0.265	0.227 0.274	0.234 0.284	0.242 0.293	0.250 0.303	0.258 0.312	0.266 0.321	0.273 0.331
1/16	0.375 0.454	0.391 0.473	0.406 0.492	0.422 0.511	0.438 0.529	0.453 0.548	0.469 0.567	0.484 0.586	0.500 0.605	0.516 0.624	0.531 0.643	0.547 0.662
3/32	0.563 0.681	0.586 0.709	0.609 0.737	0.633 0.766	0.656 0.794	0.680 0.822	0.703 0.851	0.727 0.879	0.750 0.908	0.773 0.936	0.797 0.964	0.820 0.993
1/8	0.750 0.908	0.781 0.945	0.813 0.983	0.844 1.021	0.875 1.059	0.906 1.097	0.938 1.134	0.969 1.172	1.000 1.210	1.031 1.248	1.063 1.286	1.094 1.323
5/32	0.938 1.134	0.977 1.182	1.016 1.229	1.055 1.276	1.094 1.323	1.133 1.371	1.172 1.418	1.211 1.465	1.250 1.513	1.289 1.560	1.328 1.607	1.367 1.654
3/16	1.125 1.361	1.172 1.418	1.219 1.475	1.266 1.531	1.313 1.588	1.359 1.645	1.406 1.702	1.453 1.758	1.500 1.815	1.547 1.872	1.594 1.928	1.641 1.985
7/32	1.313 1.588	1.367 1.654	1.422 1.721	1.477 1.787	1.531 1.853	1.586 1.919	1.641 1.985	1.695 2.051	1.750 2.118	1.805 2.184	1.859 2.250	1.914 2.316
1/4	1.500 1.815	1.563 1.891	1.625 1.966	1.688 2.042	1.750 2.118	1.813 2.193	1.875 2.269	1.938 2.344	2.000 2.420	2.063 2.496	2.125 2.571	2.188 2.647
9/32	1.688 2.042	1.758 2.127	1.828 2.212	1.898 2.297	1.969 2.382	2.039 2.467	2.109 2.552	2.180 2.637	2.250 2.723	2.320 2.808	2.391 2.893	2.461 2.978
5/16	1.875 2.269	1.953 2.363	2.031 2.458	2.109 2.552	2.188 2.647	2.266 2.741	2.344 2.836	2.422 2.931	2.500 3.025	2.578 3.120	2.656 3.214	2.734 3.309
11/32	2.063 2.496	2.148 2.600	2.234 2.704	2.320 2.808	2.406 2.912	2.492 3.016	2.578 3.120	2.664 3.224	2.750 3.328	2.836 3.432	2.922 3.536	3.008 3.640
3/8	2.250 2.723	2.344 2.836	2.438 2.949	2.531 3.063	2.625 3.176	2.719 3.290	2.813 3.403	2.906 3.517	3.000 3.630	3.094 3.743	3.188 3.857	3.281 3.970
7/16	2.625 3.176	2.734 3.309	2.844 3.441	2.953 3.573	3.063 3.706	3.172 3.838	3.281 3.970	3.391 4.103	3.500 4.235	3.609 4.367	3.719 4.500	3.828 4.632
1/2	3.000 3.630	3.125 3.781	3.250 3.933	3.375 4.084	3.500 4.235	3.625 4.386	3.750 4.538	3.875 4.689	4.000 4.840	4.125 4.991	4.250 5.143	4.375 5.294
9/16	3.375 4.084	3.516 4.254	3.656 4.424	3.797 4.594	3.938 4.764	4.078 4.935	4.219 5.105	4.359 5.275	4.500 5.445	4.641 5.615	4.781 5.785	4.922 5.956
5/8	3.750 4.538	3.906 4.727	4.063 4.916	4.219 5.105	4.375 5.294	4.531 5.483	4.688 5.672	4.844 5.861	5.000 6.050	5.156 6.239	5.313 6.428	5.469 6.617
11/16	4.125 4.991	4.297 5.199	4.469 5.407	4.641 5.615	4.813 5.823	4.984 6.031	5.156 6.239	5.328 6.447	5.500 6.655	5.672 6.863	5.844 7.071	6.016 7.279
3/4	4.500 5.445	4.688 5.672	4.875 5.899	5.063 6.126	5.250 6.353	5.438 6.579	5.625 6.806	5.813 7.033	6.000 7.260	6.188 7.487	6.375 7.714	6.563 7.941

TABLE 10—*Continued*

AREAS AND WEIGHTS OF RECTANGULAR SECTIONS

Upper Value is Area in Square Inches—Lower Value is Weight in Pounds per Lineal Foot

THICKNESS, inches	Width inches	9	9¼	9½	9¾	10	10¼	10½	10¾	11	11¼	11½	11¾
	1/32	0.281 0.340	0.289 0.350	0.297 0.359	0.305 0.369	0.313 0.378	0.320 0.388	0.328 0.397	0.336 0.407	0.344 0.416	0.352 0.425	0.359 0.435	0.367 0.444
	1/16	0.563 0.681	0.578 0.700	0.594 0.718	0.609 0.737	0.625 0.756	0.641 0.775	0.656 0.794	0.672 0.813	0.688 0.832	0.703 0.851	0.719 0.870	0.734 0.889
	3/32	0.844 1.021	0.867 1.049	0.891 1.078	0.914 1.106	0.938 1.134	0.961 1.163	0.984 1.191	1.008 1.220	1.031 1.248	1.055 1.276	1.078 1.305	1.102 1.333
	1/8	1.125 1.361	1.156 1.399	1.188 1.437	1.219 1.475	1.250 1.513	1.281 1.550	1.313 1.588	1.344 1.626	1.375 1.664	1.406 1.702	1.438 1.739	1.469 1.777
	5/32	1.406 1.702	1.445 1.749	1.484 1.796	1.523 1.843	1.563 1.891	1.602 1.938	1.641 1.985	1.680 2.032	1.719 2.080	1.758 2.127	1.797 2.174	1.836 2.222
	3/16	1.688 2.042	1.734 2.099	1.781 2.155	1.828 2.212	1.875 2.269	1.922 2.326	1.969 2.382	2.016 2.439	2.063 2.496	2.109 2.552	2.156 2.609	2.203 2.666
	7/32	1.969 2.382	2.023 2.448	2.078 2.515	2.133 2.581	2.188 2.647	2.242 2.713	2.297 2.779	2.352 2.845	2.406 2.912	2.461 2.978	2.516 3.044	2.570 3.110
	1/4	2.250 2.723	2.313 2.798	2.375 2.874	2.438 2.949	2.500 3.025	2.563 3.101	2.625 3.176	2.688 3.252	2.750 3.328	2.813 3.403	2.875 3.479	2.938 3.554
	9/32	2.531 3.063	2.602 3.148	2.672 3.233	2.742 3.318	2.813 3.403	2.883 3.488	2.953 3.573	3.023 3.658	3.094 3.743	3.164 3.829	3.234 3.914	3.305 3.999
	5/16	2.813 3.403	2.891 3.498	2.969 3.592	3.047 3.687	3.125 3.781	3.203 3.876	3.281 3.970	3.359 4.065	3.438 4.159	3.516 4.254	3.594 4.348	3.672 4.443
	11/32	3.094 3.743	3.180 3.847	3.266 3.951	3.352 4.055	3.438 4.159	3.523 4.263	3.609 4.367	3.695 4.471	3.781 4.575	3.867 4.679	3.953 4.783	4.039 4.887
	3/8	3.375 4.084	3.469 4.197	3.563 4.311	3.656 4.424	3.750 4.538	3.844 4.651	3.938 4.764	4.031 4.878	4.125 4.991	4.219 5.105	4.313 5.218	4.406 5.332
	7/16	3.938 4.764	4.047 4.897	4.156 5.029	4.266 5.161	4.375 5.294	4.484 5.426	4.594 5.558	4.703 5.691	4.813 5.823	4.922 5.956	5.031 6.088	5.141 6.220
	1/2	4.500 5.445	4.625 5.596	4.750 5.748	4.875 5.899	5.000 6.050	5.125 6.201	5.250 6.353	5.375 6.504	5.500 6.655	5.625 6.806	5.750 6.958	5.875 7.109
	9/16	5.063 6.126	5.203 6.296	5.344 6.466	5.484 6.636	5.625 6.806	5.766 6.976	5.906 7.147	6.047 7.317	6.188 7.487	6.328 7.657	6.469 7.827	6.609 7.997
	5/8	5.625 6.806	5.781 6.995	5.938 7.184	6.094 7.373	6.250 7.563	6.406 7.752	6.563 7.941	6.719 8.130	6.875 8.319	7.031 8.508	7.188 8.697	7.344 8.886
	11/16	6.188 7.487	6.359 7.695	6.531 7.903	6.703 8.111	6.875 8.319	7.047 8.527	7.219 8.735	7.391 8.943	7.563 9.151	7.734 9.359	7.906 9.567	8.078 9.775
	3/4	6.750 8.168	6.938 8.394	7.125 8.621	7.313 8.848	7.500 9.075	7.688 9.302	7.875 9.529	8.063 9.756	8.250 9.983	8.438 10.209	8.625 10.436	8.813 10.663

TABLE 10—*Continued*

AREAS AND WEIGHTS OF RECTANGULAR SECTIONS

Upper Value is Area in Square Inches—Lower Value is Weight in Pounds per Lineal Foot

THICKNESS, inches	Width inches: 12	12½	13	13½	14	14½	15	15½	16	16½	17	17½
1/32	0.38 0.45	0.39 0.47	0.41 0.49	0.42 0.51	0.44 0.53	0.45 0.55	0.47 0.57	0.48 0.59	0.50 0.61	0.52 0.62	0.53 0.64	0.55 0.66
1/16	0.75 0.91	0.78 0.95	0.81 0.98	0.84 1.02	0.88 1.06	0.91 1.10	0.94 1.13	0.97 1.17	1.00 1.21	1.03 1.25	1.06 1.29	1.09 1.32
3/32	1.13 1.36	1.17 1.42	1.22 1.47	1.27 1.53	1.31 1.59	1.36 1.64	1.41 1.70	1.45 1.76	1.50 1.82	1.55 1.87	1.59 1.93	1.64 1.99
1/8	1.50 1.82	1.56 1.89	1.63 1.97	1.69 2.04	1.75 2.12	1.81 2.19	1.88 2.27	1.94 2.34	2.00 2.42	2.06 2.50	2.13 2.57	2.19 2.65
5/32	1.88 2.27	1.95 2.36	2.03 2.46	2.11 2.55	2.19 2.65	2.27 2.74	2.34 2.84	2.42 2.93	2.50 3.03	2.58 3.12	2.66 3.21	2.73 3.31
3/16	2.25 2.72	2.34 2.84	2.44 2.95	2.53 3.06	2.63 3.18	2.72 3.29	2.81 3.40	2.91 3.52	3.00 3.63	3.09 3.74	3.19 3.86	3.28 3.97
7/32	2.63 3.18	2.73 3.31	2.84 3.44	2.95 3.57	3.06 3.71	3.17 3.84	3.28 3.97	3.39 4.10	3.50 4.24	3.61 4.37	3.72 4.50	3.83 4.63
1/4	3.00 3.63	3.13 3.78	3.25 3.93	3.38 4.08	3.50 4.24	3.63 4.39	3.75 4.54	3.88 4.69	4.00 4.84	4.13 4.99	4.25 5.14	4.38 5.29
9/32	3.38 4.08	3.52 4.25	3.66 4.42	3.80 4.59	3.94 4.76	4.08 4.93	4.22 5.10	4.36 5.27	4.50 5.45	4.64 5.62	4.78 5.79	4.92 5.96
5/16	3.75 4.54	3.91 4.73	4.06 4.92	4.22 5.10	4.38 5.29	4.53 5.48	4.69 5.67	4.84 5.86	5.00 6.05	5.16 6.24	5.31 6.43	5.47 6.62
11/32	4.13 4.99	4.30 5.20	4.47 5.41	4.64 5.62	4.81 5.82	4.98 6.03	5.16 6.24	5.33 6.45	5.50 6.66	5.67 6.86	5.84 7.07	6.02 7.28
3/8	4.50 5.45	4.69 5.67	4.88 5.90	5.06 6.13	5.25 6.35	5.44 6.58	5.63 6.81	5.81 7.03	6.00 7.26	6.19 7.49	6.38 7.71	6.56 7.94
7/16	5.25 6.35	5.47 6.62	5.69 6.88	5.91 7.15	6.13 7.41	6.34 7.68	6.56 7.94	6.78 8.21	7.00 8.47	7.22 8.73	7.44 9.00	7.66 9.26
1/2	6.00 7.26	6.25 7.56	6.50 7.87	6.75 8.17	7.00 8.47	7.25 8.77	7.50 9.08	7.75 9.38	8.00 9.68	8.25 9.98	8.50 10.29	8.75 10.59
9/16	6.75 8.17	7.03 8.51	7.31 8.85	7.59 9.19	7.88 9.53	8.16 9.87	8.44 10.21	8.72 10.55	9.00 10.89	9.28 11.23	9.56 11.57	9.84 11.91
5/8	7.50 9.08	7.81 9.45	8.13 9.83	8.44 10.21	8.75 10.59	9.05 10.97	9.38 11.34	9.69 11.72	10.00 12.10	10.31 12.48	10.63 12.86	10.94 13.23
11/16	8.25 9.98	8.59 10.40	8.94 10.81	9.28 11.23	9.63 11.65	9.97 12.06	10.31 12.48	10.66 12.89	11.00 13.31	11.34 13.73	11.69 14.14	12.03 14.56
3/4	9.00 10.89	9.38 11.34	9.75 11.80	10.13 12.25	10.50 12.71	10.88 13.16	11.25 13.61	11.63 14.07	12.00 14.52	12.38 14.97	12.75 15.43	13.13 15.88

TABLE 10—*Continued*

AREAS AND WEIGHTS OF RECTANGULAR SECTIONS

Upper Value is Area in Square Inches—Lower Value is Weight in Pounds per Lineal Foot

THICKNESS, inches	Width inches	18	18½	19	19½	20	20½	21	21½	22	22½	23	23½
	1/32	0.56 0.68	0.58 0.70	0.59 0.72	0.61 0.74	0.63 0.76	0.64 0.78	0.66 0.79	0.67 0.81	0.69 0.83	0.70 0.85	0.72 0.87	0.73 0.89
	1/16	1.13 1.36	1.16 1.40	1.19 1.44	1.22 1.47	1.25 1.51	1.28 1.55	1.31 1.59	1.34 1.63	1.38 1.66	1.41 1.70	1.44 1.74	1.47 1.78
	3/32	1.69 2.04	1.73 2.10	1.78 2.16	1.83 2.21	1.88 2.27	1.92 2.33	1.97 2.38	2.02 2.44	2.06 2.50	2.11 2.55	2.16 2.61	2.20 2.67
	1/8	2.25 2.72	2.31 2.80	2.38 2.87	2.44 2.95	2.50 3.03	2.56 3.10	2.63 3.18	2.69 3.25	2.75 3.33	2.81 3.40	2.88 3.48	2.94 3.55
	5/32	2.81 3.40	2.89 3.50	2.97 3.59	3.05 3.69	3.13 3.78	3.20 3.88	3.28 3.97	3.36 4.06	3.44 4.16	3.52 4.25	3.59 4.35	3.67 4.44
	3/16	3.38 4.08	3.47 4.20	3.56 4.31	3.66 4.42	3.75 4.54	3.84 4.65	3.94 4.76	4.03 4.88	4.13 4.99	4.22 5.10	4.31 5.22	4.41 5.33
	7/32	3.94 4.76	4.05 4.90	4.16 5.03	4.27 5.16	4.38 5.29	4.48 5.43	4.59 5.56	4.70 5.69	4.81 5.82	4.92 5.96	5.03 6.09	5.14 6.22
	1/4	4.50 5.45	4.63 5.60	4.75 5.75	4.88 5.90	5.00 6.05	5.13 6.20	5.25 6.35	5.38 6.50	5.50 6.66	5.63 6.81	5.75 6.96	5.88 7.11
	9/32	5.06 6.13	5.20 6.30	5.34 6.47	5.48 6.64	5.63 6.81	5.77 6.98	5.91 7.15	6.05 7.32	6.19 7.49	6.33 7.66	6.47 7.83	6.61 8.00
	5/16	5.63 6.81	5.78 7.00	5.94 7.18	6.09 7.37	6.25 7.56	6.41 7.75	6.56 7.94	6.72 8.13	6.88 8.32	7.03 8.51	7.19 8.70	7.34 8.89
	11/32	6.19 7.49	6.36 7.69	6.53 7.90	6.70 8.11	6.88 8.32	7.05 8.53	7.22 8.73	7.39 8.94	7.56 9.15	7.73 9.36	7.91 9.57	8.08 9.77
	3/8	6.75 8.17	6.94 8.39	7.13 8.62	7.31 8.85	7.50 9.08	7.69 9.30	7.88 9.53	8.06 9.76	8.25 9.98	8.44 10.21	8.63 10.44	8.81 10.66
	7/16	7.88 9.53	8.09 9.79	8.31 10.06	8.53 10.32	8.75 10.59	8.97 10.85	9.19 11.12	9.41 11.38	9.63 11.65	9.84 11.91	10.06 12.18	10.28 12.44
	1/2	9.00 10.89	9.25 11.19	9.50 11.50	9.75 11.80	10.00 12.10	10.25 12.40	10.50 12.71	10.75 13.01	11.00 13.31	11.25 13.61	11.50 13.92	11.75 14.22
	9/16	10.13 12.25	10.41 12.59	10.69 12.93	10.97 13.27	11.25 13.61	11.53 13.95	11.81 14.29	12.09 14.63	12.38 14.97	12.66 15.31	12.94 15.65	13.22 15.99
	5/8	11.25 13.61	11.56 13.99	11.88 14.37	12.19 14.75	12.50 15.13	12.81 15.50	13.13 15.88	13.44 16.26	13.75 16.64	14.06 17.02	14.38 17.39	14.69 17.77
	11/16	12.38 14.97	12.72 15.39	13.06 15.81	13.41 16.22	13.75 16.64	14.09 17.05	14.44 17.47	14.78 17.89	15.13 18.30	15.47 18.72	15.81 19.13	16.16 19.55
	3/4	13.50 16.34	13.88 16.79	14.25 17.24	14.63 17.70	15.00 18.15	15.38 18.60	15.75 19.06	16.13 19.51	16.50 19.97	16.88 20.42	17.25 20.87	17.63 21.33

TABLE 10—*Continued*

AREAS AND WEIGHTS OF RECTANGULAR SECTIONS

Upper Value is Area in Square Inches—Lower Value is Weight in Pounds per Lineal Foot

THICKNESS, inches \ Width inches	24	25	26	27	28	29	30	31	32	33	34	35
1/32	0.75 0.91	0.78 0.95	0.81 0.98	0.84 1.02	0.88 1.06	0.91 1.10	0.94 1.13	0.97 1.17	1.00 1.21	1.03 1.25	1.06 1.29	1.09 1.32
1/16	1.50 1.82	1.56 1.89	1.63 1.97	1.69 2.04	1.75 2.12	1.81 2.19	1.88 2.27	1.94 2.34	2.00 2.42	2.06 2.50	2.13 2.57	2.19 2.65
3/32	2.25 2.72	2.34 2.84	2.44 2.95	2.53 3.06	2.63 3.18	2.72 3.29	2.81 3.40	2.91 3.52	3.00 3.63	3.09 3.74	3.19 3.86	3.28 3.97
1/8	3.00 3.63	3.13 3.78	3.25 3.93	3.38 4.08	3.50 4.24	3.63 4.39	3.75 4.54	3.88 4.69	4.00 4.84	4.13 4.99	4.25 5.14	4.38 5.29
5/32	3.75 4.54	3.91 4.73	4.06 4.92	4.22 5.10	4.38 5.29	4.53 5.48	4.69 5.67	4.84 5.86	5.00 6.05	5.16 6.24	5.31 6.43	5.47 6.62
3/16	4.50 5.45	4.69 5.67	4.88 5.90	5.06 6.13	5.25 6.35	5.44 6.58	5.63 6.81	5.81 7.03	6.00 7.26	6.19 7.49	6.38 7.71	6.56 7.94
7/32	5.25 6.35	5.47 6.62	5.69 6.88	5.91 7.15	6.13 7.41	6.34 7.68	6.56 7.94	6.78 8.21	7.00 8.47	7.22 8.73	7.44 9.00	7.66 9.26
1/4	6.00 7.26	6.25 7.56	6.50 7.87	6.75 8.17	7.00 8.47	7.25 8.77	7.50 9.08	7.75 9.38	8.00 9.68	8.25 9.98	8.50 10.29	8.75 10.59
9/32	6.75 8.17	7.03 8.51	7.31 8.85	7.59 9.19	7.88 9.53	8.16 9.87	8.44 10.21	8.72 10.55	9.00 10.89	9.28 11.23	9.56 11.57	9.84 11.91
5/16	7.50 9.08	7.81 9.45	8.13 9.83	8.44 10.21	8.75 10.59	9.06 10.97	9.38 11.34	9.69 11.72	10.00 12.10	10.31 12.48	10.63 12.86	10.94 13.23
11/32	8.25 9.98	8.59 10.40	8.94 10.81	9.28 11.23	9.63 11.65	9.97 12.06	10.31 12.48	10.66 12.89	11.00 13.31	11.34 13.73	11.69 14.14	12.03 14.56
3/8	9.00 10.89	9.38 11.34	9.75 11.80	10.13 12.25	10.50 12.71	10.88 13.16	11.25 13.61	11.63 14.07	12.00 14.52	12.38 14.97	12.75 15.43	13.13 15.88
7/16	10.50 12.71	10.94 13.23	11.38 13.76	11.81 14.29	12.25 14.82	12.69 15.35	13.13 15.88	13.56 16.41	14.00 16.94	14.44 17.47	14.88 18.00	15.31 18.53
1/2	12.00 14.52	12.50 15.13	13.00 15.73	13.50 16.34	14.00 16.94	14.50 17.55	15.00 18.15	15.50 18.76	16.00 19.36	16.50 19.97	17.00 20.57	17.50 21.18
9/16	13.50 16.34	14.06 17.02	14.63 17.70	15.19 18.38	15.75 19.06	16.31 19.74	16.88 20.42	17.44 21.10	18.00 21.78	18.56 22.46	19.13 23.14	19.69 23.82
5/8	15.00 18.15	15.63 18.91	16.25 19.66	16.88 20.42	17.50 21.18	18.13 21.93	18.75 22.69	19.38 23.44	20.00 24.20	20.63 24.96	21.25 25.71	21.88 26.47
11/16	16.50 19.97	17.19 20.80	17.88 21.63	18.56 22.46	19.25 23.29	19.94 24.12	20.63 24.96	21.31 25.79	22.00 26.62	22.69 27.45	23.38 28.28	24.06 29.12
3/4	18.00 21.78	18.75 22.69	19.50 23.60	20.25 24.50	21.00 25.41	21.75 26.32	22.50 27.23	23.25 28.13	24.00 29.04	24.75 29.95	25.50 30.86	26.25 31.76

TABLE 10—*Continued*

AREAS AND WEIGHTS OF RECTANGULAR SECTIONS

Upper Value is Area in Square Inches—Lower Value is Weight in Pounds per Lineal Foot

THICKNESS, inches	Width inches 36	37	38	39	40	41	42	43	44	45	46	47
1/32	1.13 1.36	1.16 1.40	1.19 1.44	1.22 1.47	1.25 1.51	1.28 1.55	1.31 1.59	1.34 1.63	1.38 1.66	1.41 1.70	1.44 1.74	1.47 1.78
1/16	2.25 2.72	2.31 2.80	2.38 2.87	2.44 2.95	2.50 3.03	2.56 3.10	2.63 3.18	2.69 3.25	2.75 3.33	2.81 3.40	2.88 3.48	2.94 3.55
3/32	3.38 4.08	3.47 4.20	3.56 4.31	3.66 4.42	3.75 4.54	3.84 4.65	3.94 4.76	4.03 4.88	4.13 4.99	4.22 5.10	4.31 5.22	4.41 5.33
1/8	4.50 5.45	4.63 5.60	4.75 5.75	4.88 5.90	5.00 6.05	5.13 6.20	5.25 6.35	5.38 6.50	5.50 6.66	5.63 6.81	5.75 6.96	5.88 7.11
5/32	5.63 6.81	5.78 7.00	5.94 7.18	6.09 7.37	6.25 7.56	6.41 7.75	6.56 7.94	6.72 8.13	6.88 8.32	7.03 8.51	7.19 8.70	7.34 8.89
3/16	6.75 8.17	6.94 8.39	7.13 8.62	7.31 8.85	7.50 9.08	7.69 9.30	7.88 9.53	8.06 9.76	8.25 9.98	8.44 10.21	8.63 10.44	8.81 10.66
7/32	7.88 9.53	8.09 9.79	8.31 10.06	8.53 10.32	8.75 10.59	8.97 10.85	9.19 11.12	9.41 11.38	9.63 11.65	9.84 11.91	10.06 12.18	10.28 12.44
1/4	9.00 10.89	9.25 11.19	9.50 11.50	9.75 11.80	10.00 12.10	10.25 12.40	10.50 12.71	10.75 13.01	11.00 13.31	11.25 13.61	11.50 13.92	11.75 14.22
9/32	10.13 12.25	10.41 12.59	10.69 12.93	10.97 13.27	11.25 13.61	11.53 13.95	11.81 14.29	12.09 14.63	12.38 14.97	12.66 15.31	12.94 15.65	13.22 15.99
5/16	11.25 13.61	11.56 13.99	11.88 14.37	12.19 14.75	12.50 15.13	12.81 15.50	13.13 15.88	13.44 16.26	13.75 16.64	14.06 17.02	14.38 17.39	14.69 17.77
11/32	12.38 14.97	12.72 15.39	13.06 15.81	13.41 16.22	13.75 16.64	14.09 17.05	14.44 17.47	14.78 17.89	15.13 18.30	15.47 18.72	15.81 19.13	16.16 19.55
3/8	13.50 16.34	13.88 16.79	14.25 17.24	14.63 17.70	15.00 18.15	15.38 18.60	15.75 19.06	16.13 19.51	16.50 19.97	16.88 20.42	17.25 20.87	17.63 21.33
7/16	15.75 19.06	16.19 19.59	16.63 20.12	17.06 20.65	17.50 21.18	17.94 21.70	18.38 22.23	18.81 22.76	19.25 23.29	19.69 23.82	20.13 24.35	20.56 24.88
1/2	18.00 21.78	18.50 22.39	19.00 22.99	19.50 23.60	20.00 24.20	20.50 24.81	21.00 25.41	21.50 26.02	22.00 26.62	22.50 27.23	23.00 27.83	23.50 28.44
9/16	20.25 24.50	20.81 25.18	21.38 25.86	21.94 26.54	22.50 27.23	23.06 27.91	23.63 28.59	24.19 29.27	24.75 29.95	25.31 30.63	25.88 31.31	26.44 31.99
5/8	22.50 27.23	23.13 27.98	23.75 28.74	24.38 29.49	25.00 30.25	25.63 31.01	26.25 31.76	26.88 32.52	27.50 33.28	28.13 34.03	28.75 34.79	29.38 35.54
11/16	24.75 29.95	25.44 30.78	26.13 31.61	26.81 32.44	27.50 33.28	28.19 34.11	28.88 34.94	29.56 35.77	30.25 36.60	30.94 37.43	31.63 38.27	32.31 39.10
3/4	27.00 32.67	27.75 33.58	28.50 34.49	29.25 35.39	30.00 36.30	30.75 37.21	31.50 38.12	32.25 39.02	33.00 39.93	33.75 40.84	34.50 41.75	35.25 42.65

TABLE 10—*Continued*

AREAS AND WEIGHTS OF RECTANGULAR SECTIONS

Upper Value is Area in Square Inches—Lower Value is Weight in Pounds per Lineal Foot

THICKNESS, inches	Width inches 48	49	50	51	52	53	54	55	56	57	58	59
1/32	1.50 1.82	1.53 1.85	1.56 1.89	1.59 1.93	1.63 1.97	1.66 2.00	1.69 2.04	1.72 2.08	1.75 2.12	1.78 2.16	1.81 2.19	1.84 2.23
1/16	3.00 3.63	3.06 3.71	3.13 3.78	3.19 3.86	3.25 3.93	3.31 4.01	3.38 4.08	3.44 4.16	3.50 4.24	3.56 4.31	3.63 4.39	3.69 4.46
3/32	4.50 5.45	4.59 5.56	4.69 5.67	4.78 5.79	4.88 5.90	4.97 6.01	5.06 6.13	5.16 6.24	5.25 6.35	5.34 6.47	5.44 6.58	5.53 6.69
1/8	6.00 7.26	6.13 7.41	6.25 7.56	6.38 7.71	6.50 7.87	6.63 8.02	6.75 8.17	6.88 8.32	7.00 8.47	7.13 8.62	7.25 8.77	7.38 8.92
5/32	7.50 9.08	7.66 9.26	7.81 9.45	7.97 9.64	8.13 9.83	8.28 10.02	8.44 10.21	8.59 10.40	8.75 10.59	8.91 10.78	9.06 10.97	9.22 11.15
3/16	9.00 10.89	9.19 11.12	9.38 11.34	9.56 11.57	9.75 11.80	9.94 12.02	10.13 12.25	10.31 12.48	10.50 12.71	10.69 12.93	10.88 13.16	11.06 13.39
7/32	10.50 12.71	10.72 12.97	10.94 13.23	11.16 13.50	11.38 13.76	11.59 14.03	11.81 14.29	12.03 14.56	12.25 14.82	12.47 15.09	12.69 15.35	12.91 15.62
1/4	12.00 14.52	12.25 14.82	12.50 15.13	12.75 15.43	13.00 15.73	13.25 16.03	13.50 16.34	13.75 16.64	14.00 16.94	14.25 17.24	14.50 17.55	14.75 17.85
9/32	13.50 16.34	13.78 16.68	14.06 17.02	14.34 17.36	14.63 17.70	14.91 18.04	15.19 18.38	15.47 18.72	15.75 19.06	16.03 19.40	16.31 19.74	16.59 20.08
5/16	15.00 18.15	15.31 18.53	15.63 18.91	15.94 19.28	16.25 19.66	16.56 20.04	16.88 20.42	17.19 20.80	17.50 21.18	17.81 21.55	18.13 21.93	18.44 22.31
11/32	16.50 19.97	16.84 20.38	17.19 20.80	17.53 21.21	17.88 21.63	18.22 22.04	18.56 22.46	18.91 22.88	19.25 23.29	19.59 23.71	19.94 24.12	20.28 24.54
3/8	18.00 21.78	18.38 22.23	18.75 22.69	19.13 23.14	19.50 23.60	19.88 24.05	20.25 24.50	20.63 24.96	21.00 25.41	21.38 25.86	21.75 26.32	22.13 26.77
7/16	21.00 25.41	21.44 25.94	21.88 26.47	22.31 27.00	22.75 27.53	23.19 28.06	23.63 28.59	24.06 29.12	24.50 29.65	24.94 30.17	25.38 30.70	25.81 31.23
1/2	24.00 29.04	24.50 29.65	25.00 30.25	25.50 30.86	26.00 31.46	26.50 32.07	27.00 32.67	27.50 33.28	28.00 33.88	28.50 34.49	29.00 35.09	29.50 35.70
9/16	27.00 32.67	27.56 33.35	28.13 34.03	28.69 34.71	29.25 35.39	29.81 36.07	30.38 36.75	30.94 37.43	31.50 38.12	32.06 38.80	32.63 39.48	33.19 40.16
5/8	30.00 36.30	30.63 37.06	31.25 37.81	31.88 38.57	32.50 39.33	33.13 40.08	33.75 40.84	34.38 41.59	35.00 42.35	35.63 43.11	36.25 43.86	36.88 44.62
11/16	33.00 39.93	33.69 40.76	34.38 41.59	35.06 42.43	35.75 43.26	36.44 44.09	37.13 44.92	37.81 45.75	38.50 46.59	39.19 47.42	39.88 48.25	40.56 49.08
3/4	36.00 43.56	36.75 44.47	37.50 45.38	38.25 46.28	39.00 47.19	39.75 48.10	40.50 49.01	41.25 49.91	42.00 50.82	42.75 51.73	43.50 52.64	44.25 53.54

TABLE 10—*Continued*

AREAS AND WEIGHTS OF RECTANGULAR SECTIONS

Upper Value is Area in Square Inches—Lower Value is Weight in Pounds per Lineal Foot

THICKNESS, inches	Width inches 60	61	62	63	64	65	66	67	68	69	70	72
1/32	1.88 2.27	1.91 2.31	1.94 2.34	1.97 2.38	2.00 2.42	2.03 2.46	2.06 2.50	2.09 2.53	2.13 2.57	2.16 2.61	2.19 2.65	2.25 2.72
1/16	3.75 4.54	3.81 4.61	3.88 4.69	3.94 4.76	4.00 4.84	4.06 4.92	4.13 4.99	4.19 5.07	4.25 5.14	4.31 5.22	4.38 5.29	4.50 5.45
3/32	5.63 6.81	5.72 6.92	5.81 7.03	5.91 7.15	6.00 7.26	6.09 7.37	6.19 7.49	6.28 7.60	6.38 7.71	6.47 7.83	6.56 7.94	6.75 8.17
1/8	7.50 9.08	7.63 9.23	7.75 9.38	7.88 9.53	8.00 9.68	8.13 9.83	8.25 9.98	8.38 10.13	8.50 10.29	8.63 10.44	8.75 10.59	9.00 10.89
5/32	9.38 11.34	9.53 11.53	9.69 11.72	9.84 11.91	10.00 12.10	10.16 12.29	10.31 12.48	10.47 12.67	10.63 12.86	10.78 13.05	10.94 13.23	11.25 13.61
3/16	11.25 13.61	11.44 13.84	11.63 14.07	11.81 14.29	12.00 14.52	12.19 14.75	12.38 14.97	12.56 15.20	12.75 15.43	12.94 15.65	13.13 15.88	13.50 16.34
7/32	13.13 15.88	13.34 16.15	13.56 16.41	13.78 16.68	14.00 16.94	14.22 17.20	14.44 17.47	14.66 17.73	14.88 18.00	15.09 18.26	15.31 18.53	15.75 19.06
1/4	15.00 18.15	15.25 18.45	15.50 18.76	15.75 19.06	16.00 19.36	16.25 19.66	16.50 19.97	16.75 20.27	17.00 20.57	17.25 20.87	17.50 21.18	18.00 21.78
9/32	16.88 20.42	17.16 20.76	17.44 21.10	17.72 21.44	18.00 21.78	18.28 22.12	18.56 22.46	18.84 22.80	19.13 23.14	19.41 23.48	19.69 23.82	20.25 24.50
5/16	18.75 22.69	19.06 23.07	19.38 23.44	19.69 23.82	20.00 24.20	20.31 24.58	20.63 24.96	20.94 25.33	21.25 25.71	21.56 26.09	21.88 26.47	22.50 27.23
11/32	20.63 24.96	20.97 25.37	21.31 25.79	21.66 26.20	22.00 26.62	22.34 27.04	22.69 27.45	23.03 27.87	23.38 28.28	23.72 28.70	24.06 29.12	24.75 29.95
3/8	22.50 27.23	22.88 27.68	23.25 28.13	23.63 28.59	24.00 29.04	24.38 29.49	24.75 29.95	25.13 30.40	25.50 30.86	25.88 31.31	26.25 31.76	27.00 32.67
7/16	26.25 31.76	26.69 32.29	27.13 32.82	27.56 33.35	28.00 33.88	28.44 34.41	28.88 34.94	29.31 35.47	29.75 36.00	30.19 36.53	30.63 37.06	31.50 38.12
1/2	30.00 36.30	30.50 36.91	31.00 37.51	31.50 38.12	32.00 38.72	32.50 39.33	33.00 39.93	33.50 40.54	34.00 41.14	34.50 41.75	35.00 42.35	36.00 43.56
9/16	33.75 40.84	34.31 41.52	34.88 42.20	35.44 42.88	36.00 43.56	36.56 44.24	37.13 44.92	37.69 45.60	38.25 46.28	38.81 46.96	39.38 47.64	40.50 49.01
5/8	37.50 45.38	38.13 46.13	38.75 46.89	39.38 47.64	40.00 48.40	40.63 49.16	41.25 49.91	41.88 50.67	42.50 51.43	43.13 52.18	43.75 52.94	45.00 54.45
11/16	41.25 49.91	41.94 50.74	42.63 51.58	43.31 52.41	44.00 53.24	44.69 54.07	45.38 54.90	46.06 55.74	46.75 56.57	47.44 57.40	48.13 58.23	49.50 59.90
3/4	45.00 54.45	45.75 55.36	46.50 56.27	47.25 57.17	48.00 58.08	48.75 58.99	49.50 59.90	50.25 60.80	51.00 61.71	51.75 62.62	52.50 63.53	54.00 65.34

TABLE 11

MOMENTS OF INERTIA OF RECTANGULAR SECTIONS

ABOUT THE AXIS THROUGH CENTER NORMAL TO DEPTH

In Inches[4]

Depth in.	THICKNESS, inches											
	1/32	1/16	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
1	0.003	0.005	0.010	0.016	0.021	0.026	0.031	0.042	0.05	0.06	0.07	0.08
1/16	0.003	0.006	0.012	0.019	0.025	0.031	0.037	0.050	0.06	0.07	0.09	0.10
1/8	0.004	0.007	0.015	0.022	0.030	0.037	0.045	0.059	0.07	0.09	0.10	0.12
3/16	0.004	0.009	0.017	0.026	0.035	0.044	0.052	0.070	0.09	0.10	0.12	0.14
1/4	0.005	0.010	0.020	0.031	0.041	0.051	0.061	0.081	0.10	0.12	0.14	0.16
5/16	0.006	0.012	0.024	0.035	0.047	0.059	0.071	0.094	0.12	0.14	0.16	0.19
3/8	0.007	0.014	0.027	0.041	0.054	0.068	0.081	0.108	0.14	0.16	0.19	0.22
7/16	0.008	0.015	0.031	0.046	0.062	0.077	0.093	0.124	0.15	0.19	0.22	0.25
1/2	0.009	0.018	0.035	0.053	0.070	0.088	0.106	0.141	0.18	0.21	0.25	0.28
9/16	0.010	0.020	0.040	0.060	0.079	0.099	0.119	0.159	0.20	0.24	0.28	0.32
5/8	0.011	0.022	0.045	0.067	0.089	0.112	0.134	0.179	0.22	0.27	0.31	0.36
11/16	0.013	0.025	0.050	0.075	0.100	0.125	0.150	0.200	0.25	0.30	0.35	0.40
3/4	0.014	0.028	0.056	0.084	0.112	0.140	0.168	0.223	0.28	0.34	0.39	0.45
13/16	0.016	0.031	0.062	0.093	0.124	0.155	0.186	0.248	0.31	0.37	0.43	0.50
7/8	0.017	0.034	0.069	0.103	0.137	0.172	0.206	0.275	0.34	0.41	0.48	0.55
15/16	0.019	0.038	0.076	0.114	0.152	0.189	0.227	0.303	0.38	0.45	0.53	0.61
2	0.021	0.042	0.083	0.125	0.167	0.208	0.250	0.333	0.42	0.50	0.58	0.67
1/8	0.025	0.050	0.100	0.150	0.200	0.250	0.300	0.400	0.50	0.60	0.70	0.80
1/4	0.030	0.059	0.119	0.178	0.237	0.297	0.356	0.475	0.59	0.71	0.83	0.95
3/8	0.035	0.070	0.140	0.209	0.279	0.349	0.419	0.558	0.70	0.84	0.98	1.12
1/2	0.041	0.081	0.163	0.244	0.326	0.407	0.488	0.651	0.81	0.98	1.14	1.30
5/8	0.047	0.094	0.188	0.283	0.377	0.471	0.565	0.754	0.94	1.13	1.32	1.51
3/4	0.054	0.108	0.217	0.325	0.433	0.542	0.650	0.867	1.08	1.30	1.52	1.73
7/8	0.062	0.124	0.248	0.371	0.495	0.619	0.743	0.990	1.24	1.49	1.73	1.98
3	0.070	0.141	0.281	0.422	0.563	0.703	0.844	1.125	1.41	1.69	1.97	2.25
1/8	0.079	0.159	0.318	0.477	0.636	0.795	0.954	1.272	1.59	1.91	2.23	2.54
1/4	0.089	0.179	0.358	0.536	0.715	0.894	1.073	1.430	1.79	2.15	2.50	2.86
3/8	0.100	0.200	0.401	0.601	0.801	1.001	1.201	1.602	2.00	2.40	2.80	3.20
1/2	0.112	0.223	0.447	0.670	0.893	1.117	1.340	1.787	2.23	2.68	3.13	3.57
5/8	0.124	0.248	0.496	0.744	0.992	1.241	1.489	1.985	2.48	2.98	3.47	3.97
3/4	0.137	0.275	0.549	0.824	1.099	1.373	1.648	2.197	2.75	3.30	3.85	4.39
7/8	0.152	0.303	0.606	0.909	1.212	1.515	1.818	2.424	3.03	3.64	4.24	4.85
4	0.167	0.333	0.667	1.000	1.333	1.667	2.000	2.667	3.33	4.00	4.67	5.33
1/8	0.183	0.366	0.731	1.097	1.462	1.828	2.193	2.925	3.66	4.39	5.12	5.85
1/4	0.200	0.400	0.800	1.200	1.599	1.999	2.399	3.199	4.00	4.80	5.60	6.40
3/8	0.218	0.436	0.872	1.308	1.745	2.181	2.617	3.489	4.36	5.23	6.11	6.98
1/2	0.237	0.475	0.949	1.424	1.898	2.373	2.848	3.797	4.75	5.70	6.64	7.59
5/8	0.253	0.515	1.031	1.546	2.061	2.576	3.092	4.122	5.15	6.18	7.21	8.24
3/4	0.279	0.558	1.116	1.675	2.233	2.791	3.349	4.466	5.58	6.70	7.81	8.93
7/8	0.302	0.603	1.207	1.810	2.414	3.017	3.621	4.827	6.03	7.24	8.45	9.65

TABLE 11—*Continued*

MOMENTS OF INERTIA OF RECTANGULAR SECTIONS

ABOUT THE AXIS THROUGH CENTER NORMAL TO DEPTH

In Inches^4

Depth in.	THICKNESS, inches											
	1/32	1/16	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
5	0.33	0.65	1.30	1.95	2.60	3.26	3.9	5.2	6.5	7.8	9.1	10.4
1/8	0.35	0.70	1.40	2.10	2.80	3.51	4.2	5.6	7.0	8.4	9.8	11.2
1/4	0.38	0.75	1.51	2.26	3.01	3.77	4.5	6.0	7.5	9.0	10.6	12.1
3/8	0.40	0.81	1.62	2.43	3.24	4.04	4.9	6.5	8.1	9.7	11.3	12.9
1/2	0.43	0.87	1.73	2.60	3.47	4.33	5.2	6.9	8.7	10.4	12.1	13.9
5/8	0.46	0.93	1.85	2.78	3.71	4.63	5.6	7.4	9.3	11.1	13.0	14.8
3/4	0.50	0.99	1.98	2.97	3.96	4.95	5.9	7.9	9.9	11.9	13.9	15.8
7/8	0.53	1.06	2.11	3.17	4.22	5.28	6.3	8.4	10.6	12.7	14.8	16.9
6	0.56	1.13	2.25	3.38	4.50	5.63	6.8	9.0	11.3	13.5	15.8	18.0
1/8	0.60	1.20	2.39	3.59	4.79	5.98	7.2	9.6	12.0	14.4	16.8	19.1
1/4	0.64	1.27	2.54	3.81	5.09	6.36	7.6	10.2	12.7	15.3	17.8	20 3
3/8	0.67	1.35	2.70	4.05	5.40	6.75	8.1	10.8	13.5	16.2	18.9	21.6
1/2	0.72	1.43	2.86	4.29	5.72	7.15	8.6	11.4	14.3	17.2	20.0	22.9
5/8	0.76	1.51	3.03	4.54	6.06	7.57	9.1	12.1	15.1	18 2	21.2	24.2
3/4	0.80	1.60	3.20	4.81	6.41	8.01	9.6	12.8	16.0	19.2	22.4	25.6
7/8	0.85	1.69	3.38	5.08	6.77	8.46	10.2	13.5	16.9	20.3	23.7	27.1
7	0.89	1.79	3.57	5.36	7.15	8.93	10.7	14.3	17.9	21.4	25.0	28.6
1/8	0.94	1.88	3.77	5.65	7.54	9.42	11.3	15.1	18.8	22.6	26.4	30.1
1/4	0.99	1.98	3.97	5.95	7.94	9.92	11.9	15.9	19.8	23.8	27.8	31.8
3/8	1.04	2.09	4.18	6.27	8.36	10.45	12.5	16.7	20.9	25.1	29.2	33.4
1/2	1.10	2.20	4.39	6.59	8.79	10.99	13.2	17.6	22.0	26.4	30.8	35.2
5/8	1.15	2.31	4.62	6.93	9.24	11.54	13.9	18.5	23.1	27.7	32.3	36.9
3/4	1.21	2.42	4.85	7.27	9.70	12.12	14.5	19.4	24.2	29.1	33.9	38.8
7/8	1.27	2.54	5.09	7.63	10.17	12.72	15.3	20.3	25.4	30.5	35.6	40.7
8	1.33	2.67	5.33	8.00	10.67	13.33	16.0	21.3	26.7	32.0	37.3	42.7
1/8	1.40	2.79	5.59	8.38	11.17	13.97	16.8	22.3	27.9	33.5	39.1	44.7
1/4	1.46	2.92	5.85	8.77	11.70	14.62	17.5	23.4	29.2	35.1	40.9	46.8
3/8	1.53	3.06	6.12	9.18	12.24	15.30	18.4	24.5	30.6	36.7	42.8	49.0
1/2	1.60	3.20	6.40	9.60	12.79	15.99	19.2	25.6	32.0	38.4	44.8	51.2
5/8	1.67	3.34	6.68	10.03	13.37	16.71	20.1	26.7	33.4	40.1	46.8	53.5
3/4	1.74	3.49	6.98	10.47	13.96	17.45	20.9	27.9	34.9	41.9	48.8	55.8
7/8	1.82	3.64	7.28	10 92	14.56	18.20	21.8	29.1	36.4	43.7	51.0	58.3
9	1.90	3.80	7.59	11.39	15.19	18.98	22.8	30.4	38.0	45.6	53.2	60.8
1/8	1.98	3.96	7.91	11.87	15.83	19.79	23.7	31.7	39.6	47.5	55.4	63.3
1/4	2.06	4.12	8.24	12.37	16.49	20.61	24.7	33.0	41.2	49.5	57.7	66.0
3/8	2.15	4.29	8.58	12.87	17.17	21.46	25.7	34.3	42.9	51.5	60.1	68.7
1/2	2.23	4.47	8.93	13.40	17.86	22.33	26.8	35.7	44.7	53.6	62.5	71.4
5/8	2.32	4.64	9.29	13.93	18.58	23.22	27.9	37.2	46.4	55.7	65.0	74.3
3/4	2.41	4.83	9.65	14.48	19.31	24.14	29.0	38.6	48.3	57.9	67.6	77.2
7/8	2.51	5.02	10.03	15.05	20.06	25.08	30.1	40.1	50.2	60.2	70.2	80.2

TABLE 11—*Continued*

MOMENTS OF INERTIA OF RECTANGULAR SECTIONS

ABOUT THE AXIS THROUGH CENTER NORMAL TO DEPTH

In Inches[4]

Depth in.	THICKNESS, inches											
	1/32	1/16	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
10	2.60	5.21	10.42	15.63	20.83	26.04	31.3	41.7	52.1	62.5	72.9	83.3
1/8	2.70	5.41	10.81	16.22	21.62	27.03	32.4	43.2	54.1	64.9	75.7	86.5
1/4	2.80	5.61	11.22	16.83	22.44	28.04	33 7	44.9	56.1	67.3	78.5	89 7
3/8	2.91	5.82	11.63	17.45	23.27	29.08	34.9	46.5	58.2	69.8	81.4	93 1
1/2	3.01	6.03	12.06	18.09	24.12	30.15	36.2	48.2	60.3	72.4	84 4	96.5
5/8	3.12	6.25	12.49	18.74	24.99	31.24	37.5	50.0	62.5	75.0	87.5	100 0
3/4	3.24	6.47	12.94	19.41	25.88	32.35	38.8	51.8	64.7	77.6	90.6	103.5
7/8	3.35	6.70	13.40	20.10	26.79	33.49	40.2	53.6	67.0	80.4	93 8	107.2
11	3.47	6.93	13.86	20.80	27.73	34.66	41.6	55.5	69.3	83.2	97 1	110.9
1/8	3.59	7.17	14.34	21.51	28.69	35.86	43.0	57.4	71.7	86.1	100 4	114.7
1/4	3.71	7.42	14.83	22.25	29.66	37.08	44.5	59.3	74 2	89.0	103.8	118.7
3/8	3.83	7.67	15.33	23.00	30.66	38.33	46.0	61.3	76.7	92.0	107.3	122.7
1/2	3.96	7.92	15.84	23.76	31.69	39.61	47.5	63.4	79.2	95.1	110.9	126.7
5/8	4.09	8.18	16.36	24.55	32.73	40 91	49.1	65.5	81.8	98.2	114.6	130 9
3/4	4.22	8.45	16.90	25.35	33.80	42 25	50.7	67.6	84.5	101.4	118 3	135.2
7/8	4.36	8.72	17.44	26.17	34.89	43.61	52.3	69.8	87.2	104.7	122.1	139 5
12	4.50	9.00	18.00	27.00	36.00	45 00	54.0	72.0	90.0	108.0	126.0	144.0
1/8	4.64	9.28	18.57	27.85	37.14	46 42	55.7	74.3	92.8	111.4	130.0	148.5
1/4	4.79	9.57	19.15	28.72	38.30	47.87	57.4	76.6	95.7	114.9	134.0	153 2
3/8	4.94	9.87	19.74	29.61	39.48	49.35	59.2	79.0	98.7	118.4	138.2	157.9
1/2	5.09	10.17	20.35	30.52	40.69	50.86	61.0	81.4	101.7	122.1	142.4	162 8
5/8	5.24	10.48	20.96	31.44	41.92	52.40	62.9	83.8	104.8	125.8	146 7	167 7
3/4	5.40	10.80	21.59	32.39	43.18	53.98	64.8	86.4	108.0	129.5	151 1	172 7
7/8	5.56	11.12	22.23	33.35	44.46	55.58	66.7	88.9	111.2	133.4	155.6	177.9
13	5.72	11.44	22.89	34.33	45.77	57.21	68.7	91.5	114.4	137.3	160.2	183 1
1/8	5.89	11.78	23.55	35.33	47.10	58.88	70.7	94.2	117.8	141.3	164.9	188 4
1/4	6.06	12.12	24.23	36.35	48.46	60.58	72.7	96.9	121.2	145.4	169.6	193.9
3/8	6.23	12.46	24.92	37.39	49.85	62.31	74.8	99.7	124.6	149.5	174.5	199 4
1/2	6.41	12.81	25.63	38.44	51.26	64.07	76.9	102.5	128.1	153.8	179 4	205 0
5/8	6.59	13.17	26.35	39.52	52.69	65.87	79.0	105.4	131.7	158.1	184 4	210.8
3/4	6.77	13.54	27.08	40.62	54.16	67.70	81.2	108.3	135.4	162.5	189.6	216.6
7/8	6.96	13.91	27.82	41.74	55.65	69.56	83.5	111.3	139.1	166.9	194.8	222 6
14	7.15	14.29	28.58	42.88	57.17	71.46	85.8	114.3	142.9	171.5	200.1	228.7
1/8	7.34	14.68	29.36	44.03	58.71	73.39	88.1	117.4	146.8	176.1	205.5	234.8
1/4	7.54	15.07	30.14	45.21	60.28	75.36	90.4	120.6	150.7	180.9	211.0	241.1
3/8	7.74	15 47	30.94	46.41	61.88	77.36	92.8	123.8	154.7	185.7	216.6	247.5
1/2	7.94	15.88	31.76	47.63	63.51	79.39	95.3	127.0	158.8	190.5	222 3	254.1
5/8	8.15	16.29	32.58	48.88	65.17	81.46	97 8	130.3	162.9	195.5	228 1	260.7
3/4	8.36	16.71	33.43	50.14	66.86	83.57	100 3	133.7	167.1	200.6	234 0	267.4
7/8	8.57	17.14	34.28	51.43	68.57	85.71	102.9	137.1	171.4	205 7	240 0	274.3

TABLE 11—*Continued*

MOMENTS OF INERTIA OF RECTANGULAR SECTIONS

ABOUT THE AXIS THROUGH CENTER NORMAL TO DEPTH

In Inches^4

Depth in.	THICKNESS, inches											
	1/32	1/16	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
15	8.8	17.6	35.2	52.7	70.3	87.9	105	141	176	211	246	281
1/8	9.0	18.0	36.0	54.1	72.1	90.1	108	144	180	216	252	288
1/4	9.2	18.5	36.9	55.4	73.9	92.4	111	148	185	222	259	296
3/8	9.5	18.9	37.9	56.8	75.7	94.6	114	151	189	227	265	303
1/2	9.7	19.4	38.8	58.2	77.6	97.0	116	155	194	233	272	310
5/8	9.9	19.9	39.7	59.6	79.5	99.3	119	159	199	238	278	318
3/4	10.2	20.3	40.7	61.0	81.4	101.7	122	163	203	244	285	326
7/8	10.4	20.8	41.7	62.5	83.3	104.2	125	167	208	250	292	333
16	10.7	21.3	42.7	64.0	85.3	106.7	128	171	213	256	299	341
1/8	10.9	21.8	43.7	65.5	87.3	109.2	131	175	218	262	306	349
1/4	11.2	22.3	44.7	67.0	89.4	111.7	134	179	223	268	313	358
3/8	11.4	22.9	45.7	68.6	91.5	114.3	137	183	229	274	320	366
1/2	11.7	23.4	46.8	70.2	93.6	117.0	140	187	234	281	328	374
5/8	12.0	23.9	47.9	71.8	95.7	119.7	144	191	239	287	335	383
3/4	12.2	24.5	49.0	73.4	97.9	122.4	147	196	245	294	343	392
7/8	12.5	25.0	50.1	75.1	100.1	125.1	150	200	250	300	350	400
17	12.8	25.6	51.2	76.8	102.4	127.9	154	205	256	307	358	409
1/8	13.1	26.2	52.3	78.5	104.6	130.8	157	209	262	314	366	419
1/4	13.4	26.7	53.5	80.2	106.9	133.7	160	214	267	321	374	428
3/8	13.7	27.3	54.6	82.0	109.3	136.6	164	219	273	328	382	437
1/2	14.0	27.9	55.8	83.7	111.7	139.6	167	223	279	335	391	447
5/8	14.3	28.5	57.0	85.5	114.1	142.6	171	228	285	342	399	456
3/4	14.6	29.1	58.3	87.4	116.5	145.6	175	233	291	350	408	466
7/8	14.9	29.7	59.5	89.2	119.0	148.7	178	238	297	357	416	476
18	15.2	30.4	60.8	91.1	121.5	151.9	182	243	304	365	425	486
1/8	15.5	31.0	62.0	93.0	124.0	155.1	186	248	310	372	434	496
1/4	15.8	31.7	63.3	95.0	126.6	158.3	190	253	317	380	443	507
3/8	16.2	32.3	64.6	96.9	129.3	161.6	194	259	323	388	452	517
1/2	16.5	33.0	66.0	98.9	131.9	164.9	198	264	330	396	462	528
5/8	16.8	33.7	67.3	101.0	134.6	168.3	202	269	337	404	471	538
3/4	17.2	34.3	68.7	103.0	137.3	171.7	206	275	343	412	481	549
7/8	17.5	35.0	70.0	105.1	140.1	175.1	210	280	350	420	490	560
19	17.9	35.7	71.4	107.2	142.9	178.6	214	286	357	429	500	572
1/8	18.2	36.4	72.9	109.3	145.7	182.2	219	291	364	437	510	583
1/4	18.6	37.2	74.3	111.5	148.6	185.8	223	297	372	446	520	594
3/8	18.9	37.9	75.8	113.6	151.5	189.4	227	303	379	455	530	606
1/2	19.3	38.6	77.2	115.9	154.5	193.1	232	309	386	463	541	618
5/8	19.7	39.4	78.7	118.1	157.5	196.8	236	315	394	472	551	630
3/4	20.1	40.1	80.2	120.4	160.5	200.6	241	321	401	481	562	642
7/8	20.4	40.9	81.8	122.7	163.6	204.5	245	327	409	491	572	654

TABLE 11—*Continued*

MOMENTS OF INERTIA OF RECTANGULAR SECTIONS

ABOUT THE AXIS THROUGH CENTER NORMAL TO DEPTH

In Inches[4]

Depth in.	THICKNESS, inches											
	1/32	1/16	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
20	21	42	83	125	167	208	250	333	417	500	583	667
1/4	22	43	86	130	173	216	259	346	432	519	605	692
1/2	22	45	90	135	179	224	269	359	449	538	628	718
3/4	23	47	93	140	186	233	279	372	465	558	651	745
21	24	48	96	145	193	241	289	386	482	579	675	772
1/4	25	50	100	150	200	250	300	400	500	600	700	800
1/2	26	52	104	155	207	259	311	414	518	621	725	828
3/4	27	54	107	161	214	268	322	429	536	643	750	857
22	28	55	111	166	222	277	333	444	555	666	776	887
1/4	29	57	115	172	229	287	344	459	574	688	803	918
1/2	30	59	119	178	237	297	356	475	593	712	831	949
3/4	31	61	123	184	245	307	368	491	613	736	859	981
23	32	63	127	190	253	317	380	507	634	760	887	1014
1/4	33	65	131	196	262	327	393	524	655	786	916	1047
1/2	34	68	135	203	270	338	406	541	676	811	946	1082
3/4	35	70	140	209	279	349	419	558	698	837	977	1116
24	36	72	144	216	288	360	432	576	720	864	1008	1152
1/4	37	74	149	223	297	371	446	594	743	891	1040	1188
1/2	38	77	153	230	306	383	460	613	766	919	1072	1226
3/4	39	79	158	237	316	395	474	632	790	948	1105	1263
25	41	81	163	244	326	407	488	651	814	977	1139	1302
1/4	42	84	168	252	335	419	503	671	838	1006	1174	1342
1/2	43	86	173	259	345	432	518	691	864	1036	1209	1382
3/4	44	89	178	267	356	445	534	711	889	1067	1245	1423
26	46	92	183	275	366	458	549	732	915	1099	1282	1465
1/4	47	94	188	283	377	471	565	754	942	1131	1319	1507
1/2	48	97	194	291	388	485	582	775	969	1163	1357	1551
3/4	50	100	199	299	399	498	598	798	997	1196	1396	1595
27	51	103	205	308	410	513	615	820	1025	1230	1435	1640
1/4	53	105	211	316	422	527	632	843	1054	1265	1475	1686
1/2	54	108	217	325	433	542	650	867	1083	1300	1516	1733
3/4	56	111	223	334	445	556	668	890	1113	1336	1558	1781
28	57	114	229	343	457	572	686	915	1143	1372	1601	1829
1/4	59	117	235	352	470	587	705	939	1174	1409	1644	1879
1/2	60	121	241	362	482	603	723	965	1206	1447	1688	1929
3/4	62	124	248	371	495	619	743	990	1238	1485	1733	1980
29	64	127	254	381	508	635	762	1016	1270	1524	1778	2032
1/4	65	130	261	391	521	652	782	1043	1303	1564	1825	2085
1/2	67	134	267	401	535	669	802	1070	1337	1605	1872	2139
3/4	69	137	274	411	549	686	823	1097	1371	1646	1920	2194

TABLE 11—*Continued*

MOMENTS OF INERTIA OF RECTANGULAR SECTIONS

ABOUT THE AXIS THROUGH CENTER NORMAL TO DEPTH

In Inches[4]

Depth in.	THICKNESS, inches											
	1/32	1/16	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
30	70	141	281	422	563	703	844	1125	1406	1688	1969	2250
1/4	72	144	288	433	577	721	865	1153	1442	1730	2018	2307
1/2	74	148	296	443	591	739	887	1182	1478	1773	2069	2364
3/4	76	151	303	454	606	757	909	1212	1514	1817	2120	2423
31	78	155	310	465	621	776	931	1241	1552	1862	2172	2483
1/4	79	159	318	477	636	795	954	1272	1589	1907	2225	2543
1/2	81	163	326	488	651	814	977	1302	1628	1954	2279	2605
3/4	83	167	333	500	667	833	1000	1334	1667	2000	2334	2667
32	85	171	341	512	683	853	1024	1365	1707	2048	2389	2731
1/4	87	175	349	524	699	873	1048	1398	1747	2096	2446	2795
1/2	89	179	358	536	715	894	1073	1430	1788	2146	2503	2861
3/4	91	183	366	549	732	915	1098	1464	1829	2195	2561	2927
33	94	187	374	562	749	936	1123	1497	1872	2246	2620	2995
1/4	96	191	383	574	766	957	1149	1532	1915	2298	2680	3063
1/2	98	196	392	587	783	979	1175	1566	1958	2350	2741	3133
3/4	100	200	400	601	801	1001	1201	1602	2002	2403	2803	3204
34	102	205	409	614	819	1024	1228	1638	2047	2457	2866	3275
1/4	105	209	419	628	837	1046	1256	1674	2093	2511	2930	3348
1/2	107	214	428	642	856	1069	1283	1711	2139	2567	2994	3422
3/4	109	219	437	656	874	1093	1311	1748	2186	2623	3060	3497
35	112	223	447	670	893	1117	1340	1786	2233	2680	3126	3573
1/4	114	228	456	684	913	1141	1369	1825	2281	2738	3194	3650
1/2	117	233	466	699	932	1165	1398	1864	2330	2796	3262	3728
3/4	119	238	476	714	952	1190	1428	1904	2380	2856	3332	3808
36	122	243	486	729	972	1215	1458	1944	2430	2916	3402	3888
1/4	124	248	496	744	992	1240	1489	1985	2481	2977	3473	3970
1/2	127	253	507	760	1013	1266	1520	2026	2533	3039	3546	4052
3/4	129	259	517	776	1034	1293	1551	2068	2585	3102	3619	4136
37	132	264	528	791	1055	1319	1583	2111	2638	3166	3693	4221
1/4	135	269	538	808	1077	1346	1615	2154	2692	3230	3769	4307
1/2	137	275	549	824	1099	1373	1648	2197	2747	3296	3845	4395
3/4	140	280	560	841	1121	1401	1681	2242	2802	3362	3923	4483
38	143	286	572	857	1143	1429	1715	2286	2858	3430	4001	4573
1/4	146	291	583	874	1166	1457	1749	2332	2915	3498	4081	4663
1/2	149	297	594	892	1189	1486	1783	2378	2972	3567	4161	4756
3/4	152	303	606	909	1212	1515	1818	2424	3031	3637	4243	4849
39	154	309	618	927	1236	1545	1854	2472	3090	3707	4325	4943
1/4	157	315	630	945	1260	1575	1890	2519	3149	3779	4409	5039
1/2	160	321	642	963	1284	1605	1926	2568	3210	3852	4494	5136
3/4	164	327	654	981	1308	1636	1963	2617	3271	3925	4580	5234

TABLE 11—*Continued*

MOMENTS OF INERTIA OF RECTANGULAR SECTIONS

ABOUT THE AXIS THROUGH CENTER NORMAL TO DEPTH

In Inches[4]

Depth in.	THICKNESS, inches											
	1/32	1/16	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
40	167	333	667	1000	1333	1667	2000	2667	3333	4000	4667	5333
1/4	170	340	679	1019	1359	1698	2038	2717	3396	4076	4755	5434
1/2	173	346	692	1038	1384	1730	2076	2768	3460	4152	4844	5536
3/4	176	352	705	1057	1410	1762	2115	2820	3524	4229	4934	5639
41	179	359	718	1077	1436	1795	2154	2872	3590	4308	5026	5743
1/4	183	366	731	1097	1462	1828	2193	2925	3656	4387	5118	5849
1/2	186	372	745	1117	1489	1861	2234	2978	3723	4467	5212	5956
3/4	190	379	758	1137	1516	1895	2274	3032	3790	4548	5306	6064
42	193	386	772	1158	1544	1929	2315	3087	3859	4631	5402	6174
1/4	196	393	786	1178	1571	1964	2357	3142	3928	4714	5499	6285
1/2	200	400	800	1199	1599	1999	2399	3199	3998	4798	5598	6397
3/4	203	407	814	1221	1628	2035	2442	3255	4069	4883	5697	6511
43	207	414	828	1242	1656	2070	2485	3313	4141	4969	5797	6626
1/4	211	421	843	1264	1685	2107	2528	3371	4214	5056	5899	6742
1/2	214	429	857	1286	1715	2144	2572	3430	4287	5145	6002	6859
3/4	218	436	872	1308	1745	2181	2617	3489	4361	5234	6106	6978
44	222	444	887	1331	1775	2218	2662	3549	4437	5324	6211	7099
1/4	226	451	903	1354	1805	2256	2708	3610	4513	5415	6318	7220
1/2	229	459	918	1377	1836	2295	2754	3672	4590	5508	6426	7343
3/4	233	467	933	1400	1867	2334	2800	3734	4667	5601	6534	7468
45	237	475	949	1424	1898	2373	2848	3797	4746	5695	6645	7594
1/4	241	483	965	1448	1930	2413	2895	3861	4826	5791	6756	7721
1/2	245	491	981	1472	1962	2453	2944	3925	4906	5887	6868	7850
3/4	249	499	997	1496	1995	2494	2992	3990	4987	5985	6982	7980
46	253	507	1014	1521	2028	2535	3042	4056	5070	6084	7097	8111
1/4	258	515	1031	1546	2061	2576	3092	4122	5153	6183	7214	8244
1/2	262	524	1047	1571	2095	2618	3142	4189	5237	6284	7331	8379
3/4	266	532	1064	1596	2129	2661	3193	4257	5322	6386	7450	8515
47	270	541	1081	1622	2163	2704	3244	4326	5407	6489	7570	8652
1/4	275	549	1099	1648	2198	2747	3297	4395	5494	6593	7692	8791
1/2	279	558	1116	1675	2233	2791	3349	4466	5582	6698	7815	8931
3/4	284	567	1134	1701	2268	2835	3402	4536	5670	6805	7939	9073
48	288	576	1152	1728	2304	2880	3456	4608	5760	6912	8064	9216
1/4	293	585	1170	1755	2340	2925	3510	4680	5850	7021	8191	9361
1/2	297	594	1188	1783	2377	2971	3565	4754	5942	7130	8319	9507
3/4	302	603	1207	1810	2414	3017	3621	4827	6034	7241	8448	9655
49	306	613	1226	1838	2451	3064	3677	4902	6128	7353	8579	9804
1/4	311	622	1244	1867	2489	3111	3733	4977	6222	7466	8711	9955
1/2	316	632	1263	1895	2527	3159	3790	5054	6317	7580	8844	10107
3/4	321	641	1283	1924	2565	3207	3848	5131	6413	7696	8979	10261

TABLE 11—*Continued*

MOMENTS OF INERTIA OF RECTANGULAR SECTIONS

ABOUT THE AXIS THROUGH CENTER NORMAL TO DEPTH

In Inches[4]

Depth in.	THICKNESS, inches											
	1/32	1/16	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
50	326	651	1302	1953	2604	3255	3906	5208	6510	7813	9115	10417
1/4	330	661	1322	1983	2643	3304	3965	5287	6609	7930	9252	10574
1/2	335	671	1342	2012	2683	3354	4025	5366	6708	8049	9391	10732
3/4	340	681	1362	2042	2723	3404	4085	5446	6808	8169	9531	10893
51	345	691	1382	2073	2764	3454	4145	5527	6909	8291	9672	11054
1/4	351	701	1402	2103	2804	3505	4207	5609	7011	8413	9815	11218
1/2	356	711	1423	2134	2846	3557	4268	5691	7114	8537	9960	11383
3/4	361	722	1444	2165	2887	3609	4331	5775	7218	8662	10106	11549
52	366	732	1465	2197	2929	3662	4394	5859	7323	8788	10253	11717
1/4	371	743	1486	2229	2972	3715	4458	5944	7429	8915	10401	11887
1/2	377	754	1507	2261	3015	3768	4522	6029	7537	9044	10551	12059
3/4	382	764	1529	2293	3058	3822	4587	6116	7645	9174	10703	12232
53	388	775	1551	2326	3102	3877	4652	6203	7754	9305	10856	12406
1/4	393	786	1573	2359	3146	3932	4719	6291	7864	9437	11010	12583
1/2	399	798	1595	2393	3190	3988	4785	6380	7976	9571	11166	12761
3/4	404	809	1618	2426	3235	4044	4853	6470	8088	9705	11323	12941
54	410	820	1640	2460	3281	4101	4921	6561	8201	9842	11482	13122
1/4	416	832	1663	2495	3326	4158	4989	6653	8316	9979	11642	13305
1/2	422	843	1686	2529	3372	4216	5059	6745	8431	10117	11804	13490
3/4	427	855	1710	2564	3419	4274	5129	6838	8548	10257	11967	13676
55	433	867	1733	2600	3466	4333	5199	6932	8665	10398	12132	13865
1/4	439	878	1757	2635	3514	4392	5270	7027	8784	10541	12298	14055
1/2	445	890	1781	2671	3562	4452	5342	7123	8904	10685	12465	14246
3/4	451	902	1805	2707	3610	4512	5415	7220	9025	10830	12635	14440
56	457	915	1829	2744	3659	4573	5488	7317	9147	10976	12805	14635
1/4	463	927	1854	2781	3708	4635	5562	7416	9270	11124	12978	14832
1/2	470	939	1879	2818	3758	4697	5636	7515	9394	11273	13151	15030
3/4	476	952	1904	2856	3808	4760	5711	7615	9519	11423	13327	15231
57	482	965	1929	2894	3858	4823	5787	7716	9645	11575	13504	15433
1/4	489	977	1955	2932	3909	4886	5864	7818	9773	11728	13682	15637
1/2	495	990	1980	2970	3961	4951	5941	7921	9902	11882	13862	15842
3/4	502	1003	2006	3009	4013	5016	6019	8025	10031	12038	14044	16050
58	508	1016	2032	3049	4065	5081	6097	8130	10162	12195	14227	16259
1/4	515	1029	2059	3088	4118	5147	6176	8235	10294	12353	14412	16471
1/2	521	1043	2085	3128	4171	5214	6256	8342	10427	12513	14598	16684
3/4	528	1056	2112	3168	4225	5281	6337	8449	10561	12674	14786	16898
59	535	1070	2139	3209	4279	5348	6418	8557	10697	12836	14976	17115
1/4	542	1083	2167	3250	4333	5417	6500	8667	10833	13000	15167	17333
1/2	549	1097	2194	3291	4388	5486	6583	8777	10971	13165	15360	17554
3/4	555	1111	2222	3333	4444	5555	6666	8888	11110	13332	15554	17776

TABLE 11—*Continued*

MOMENTS OF INERTIA OF RECTANGULAR SECTIONS

ABOUT THE AXIS THROUGH CENTER NORMAL TO DEPTH

In Inches⁴

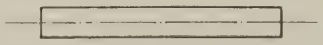
Depth in.	THICKNESS, inches											
	1/32	1/16	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
60	563	1125	2250	3375	4500	5625	6750	9000	11250	13500	15750	18000
1/4	570	1139	2278	3417	4556	5696	6835	9113	11391	13669	15948	18226
1/2	577	1153	2307	3460	4613	5767	6920	9227	11534	13840	16147	18454
3/4	584	1168	2335	3503	4671	5839	7006	9342	11677	14013	16348	18684
61	591	1182	2364	3547	4729	5911	7093	9458	11822	14186	16551	18915
1/4	598	1197	2394	3590	4787	5984	7181	9574	11968	14361	16755	19149
1/2	606	1212	2423	3635	4846	6058	7269	9692	12115	14538	16961	19384
3/4	613	1226	2453	3679	4905	6132	7358	9811	12263	14716	17169	19621
62	621	1241	2483	3724	4965	6206	7448	9930	12413	14896	17378	19861
1/4	628	1256	2513	3769	5025	6282	7538	10051	12564	15076	17589	20102
1/2	636	1272	2543	3815	5086	6358	7629	10173	12716	15259	17802	20345
3/4	643	1287	2574	3861	5148	6434	7721	10295	12869	15443	18016	20590
63	651	1302	2605	3907	5209	6512	7814	10419	13023	15628	18233	20837
1/4	659	1318	2636	3954	5272	6589	7907	10543	13179	15815	18451	21086
1/2	667	1334	2667	4001	5334	6668	8002	10669	13336	16003	18670	21337
3/4	675	1349	2699	4048	5398	6747	8096	10795	13494	16193	18892	21590
64	683	1365	2731	4096	5461	6827	8192	10923	13653	16384	19115	21845
1/4	691	1381	2763	4144	5526	6907	8288	11051	13814	16577	19340	22102
1/2	699	1398	2795	4193	5590	6988	8386	11181	13976	16771	19566	22361
3/4	707	1414	2828	4242	5656	7069	8483	11311	14139	16967	19795	22622
65	715	1430	2861	4291	5721	7152	8582	11443	14303	17164	20025	22885
1/4	723	1447	2894	4341	5788	7235	8681	11575	14469	17363	20257	23151
1/2	732	1464	2927	4391	5854	7318	8782	11709	14636	17563	20490	23418
3/4	740	1480	2961	4441	5922	7402	8883	11843	14804	17765	20726	23687
66	749	1497	2995	4492	5990	7487	8984	11979	14974	17969	20963	23958
1/4	757	1514	3029	4543	6058	7572	9087	12116	15145	18173	21202	24231
1/2	766	1532	3063	4595	6127	7658	9190	12253	15317	18380	21443	24507
3/4	775	1549	3098	4647	6196	7745	9294	12392	15490	18588	21686	24784
67	783	1566	3133	4699	6266	7832	9399	12532	15665	18798	21931	25064
1/4	792	1584	3168	4752	6336	7920	9504	12673	15841	19009	22177	25345
1/2	801	1602	3204	4805	6407	8009	9611	12815	16018	19222	22425	25629
3/4	810	1620	3239	4859	6479	8098	9718	12957	16197	19436	22675	25915
68	819	1638	3275	4913	6551	8188	9826	13101	16377	19652	22927	26203
1/4	828	1656	3312	4967	6623	8279	9935	13246	16558	19870	23181	26493
1/2	837	1674	3348	5022	6696	8370	10044	13393	16741	20089	23437	26785
3/4	846	1692	3385	5077	6770	8462	10155	13540	16925	20309	23694	27079
69	855	1711	3422	5133	6844	8555	10266	13688	17110	20532	23954	27376
1/4	865	1730	3459	5189	6919	8648	10378	13837	17297	20756	24215	27674
1/2	874	1748	3497	5245	6994	8742	10491	13988	17485	20981	24478	27975
3/4	884	1767	3535	5302	7070	8837	10604	14139	17674	21209	24743	28278

TABLE 12A

MOMENTS OF INERTIA OF RECTANGULAR SECTIONS

ABOUT THE AXIS THROUGH CENTER PARALLEL TO WIDTH

In Inches^4



Width in.	THICKNESS, inches							
	1/8	5/32	3/16	7/32	1/4	9/32	5/16	3/8
1/8	.....	.....	.0001	.0001	.0002	.0002	.0003	.0005
1/4	.....	.0001	.0001	.0002	.0003	.0005	.0006	.0011
1/2	.0001	.0002	.0003	.0004	.0007	.0009	.0013	.0022
3/4	.0001	.0002	.0004	.0007	.0010	.0014	.0019	.0033
1	.0002	.0003	.0005	.0009	.0013	.0019	.0025	.0044
1 1/4	.0002	.0004	.0007	.0011	.0016	.0023	.0032	.0055
1 1/2	.0002	.0005	.0008	.0013	.0020	.0028	.0038	.0066
1 3/4	.0003	.0006	.0010	.0015	.0023	.0032	.0045	.0077
2	.0003	.0006	.0011	.0017	.0026	.0037	.0051	.0088
2 1/4	.0004	.0007	.0012	.0020	.0029	.0042	.0057	.0099
2 1/2	.0004	.0008	.0014	.0022	.0033	.0046	.0064	.0110
2 3/4	.0004	.0009	.0015	.0024	.0036	.0051	.0070	.0121
3	.0005	.0010	.0017	.0026	.0039	.0056	.0076	.0132
3 1/4	.0005	.0010	.0018	.0028	.0042	.0060	.0083	.0143
3 1/2	.0006	.0011	.0019	.0031	.0046	.0065	.0089	.0154
3 3/4	.0006	.0012	.0021	.0033	.0049	.0070	.0095	.0165
4	.0007	.0013	.0022	.0035	.0052	.0074	.0102	.0176
4 1/2	.0007	.0014	.0025	.0039	.0059	.0083	.0114	.0198
5	.0008	.0016	.0028	.0044	.0065	.0093	.0127	.0220
5 1/2	.0009	.0018	.0030	.0048	.0072	.0102	.0140	.0242
6	.0010	.0019	.0033	.0052	.0078	.0111	.0153	.0264
6 1/2	.0011	.0021	.0036	.0057	.0085	.0121	.0165	.0286
7	.0011	.0022	.0038	.0061	.0091	.0130	.0178	.0308
7 1/2	.0012	.0024	.0041	.0065	.0098	.0139	.0191	.0330
8	.0013	.0025	.0044	.0070	.0104	.0148	.0203	.0352
9	.0015	.0029	.0049	.0079	.0117	.0167	.0229	.0396
10	.0016	.0032	.0055	.0087	.0130	.0185	.0254	.0440
11	.0018	.0035	.0060	.0096	.0143	.0204	.0280	.0483
12	.0020	.0038	.0066	.0105	.0156	.0222	.0305	.0527
14	.0023	.0045	.0077	.0122	.0182	.0260	.0356	.0615
16	.0026	.0051	.0088	.0140	.0208	.0297	.0407	.0703
18	.0029	.0057	.0099	.0157	.0234	.0334	.0458	.0791
24	.0039	.0076	.0132	.0209	.0312	.0445	.0610	.1055
30	.0049	.0095	.0165	.0262	.0391	.0556	.0763	.1319
36	.0059	.0114	.0198	.0314	.0469	.0667	.0915	.1582
42	.0068	.0134	.0231	.0366	.0547	.0779	.1068	.1846
48	.0078	.0153	.0264	.0419	.0625	.0890	.1221	.2110
60	.0098	.0191	.0329	.0523	.0781	.1112	.1526	.2637
72	.0117	.0229	.0395	.0628	.0937	.1335	.1831	.3164
84	.0137	.0267	.0461	.0733	.1094	.1557	.2136	.3692

TABLE 12B

MOMENTS OF INERTIA OF RECTANGULAR SECTIONS

ABOUT THE AXIS THROUGH CENTER PARALLEL TO WIDTH

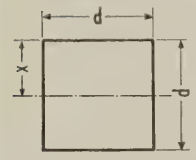
In Inches[4]

Width in.	THICKNESS, inches							
	7/16	1/2	9/16	5/8	11/16	3/4	7/8	1
1/8	.0009	.0013	0.002	0.003	0.003	0.004	0.007	0.010
1/4	.0017	.0026	0.004	0.005	0.007	0.009	0.014	0.021
1/2	.0035	.0052	0.007	0.010	0.014	0.018	0.028	0.042
3/4	.0052	.0078	0.011	0.015	0.020	0.026	0.042	0.063
1	.0070	.0104	0.015	0.020	0.027	0.035	0.056	0.083
1 1/4	.0087	.0130	0.019	0.025	0.034	0.044	0.070	0.104
1 1/2	.0105	.0156	0.022	0.031	0.041	0.053	0.084	0.125
1 3/4	.0122	.0182	0.026	0.036	0.047	0.062	0.098	0.146
2	.0140	.0208	0.030	0.041	0.054	0.070	0.112	0.167
2 1/4	.0157	.0234	0.033	0.046	0.061	0.079	0.126	0.187
2 1/2	.0174	.0260	0.037	0.051	0.068	0.088	0.140	0.208
2 3/4	.0192	.0286	0.041	0.056	0.074	0.097	0.154	0.229
3	.0209	.0313	0.045	0.061	0.081	0.106	0.168	0.250
3 1/4	.0227	.0339	0.048	0.066	0.088	0.114	0.181	0.271
3 1/2	.0244	.0365	0.052	0.071	0.095	0.123	0.195	0.292
3 3/4	.0262	.0391	0.056	0.076	0.102	0.132	0.209	0.312
4	.0279	.0417	0.059	0.081	0.108	0.141	0.223	0.333
4 1/2	.0314	.0469	0.067	0.092	0.122	0.158	0.251	0.375
5	.0349	.0521	0.074	0.102	0.135	0.176	0.279	0.417
5 1/2	.0384	.0573	0.082	0.112	0.149	0.193	0.307	0.458
6	.0419	.0625	0.089	0.122	0.163	0.211	0.335	0.500
6 1/2	.0454	.0677	0.096	0.132	0.176	0.229	0.363	0.542
7	.0488	.0729	0.104	0.142	0.190	0.246	0.391	0.583
7 1/2	.0523	.0781	0.111	0.153	0.203	0.264	0.419	0.625
8	.0558	.0833	0.119	0.163	0.217	0.281	0.447	0.667
9	.0628	.0938	0.134	0.183	0.244	0.316	0.502	0.750
10	.0698	.1042	0.148	0.204	0.271	0.352	0.558	0.833
11	.0768	.1146	0.163	0.224	0.298	0.387	0.614	0.917
12	.0837	.1250	0.178	0.244	0.325	0.422	0.670	1.000
14	.0977	.1458	0.208	0.285	0.379	0.492	0.782	1.167
16	.1116	.1667	0.237	0.326	0.433	0.562	0.893	1.333
18	.1256	.1875	0.267	0.366	0.487	0.633	1.005	1.500
24	.1675	.2500	0.356	0.488	0.650	0.844	1.340	2.000
30	.2093	.3125	0.445	0.610	0.812	1.055	1.675	2.500
36	.2512	.3750	0.534	0.732	0.975	1.266	2.010	3.000
42	.2931	.4375	0.623	0.854	1.137	1.477	2.345	3.500
48	.3349	.5000	0.712	0.977	1.300	1.688	2.680	4.000
60	.4187	.6250	0.890	1.221	1.625	2.109	3.350	5.000
72	.5024	.7500	1.068	1.465	1.950	2.531	4.020	6.000
84	.5862	.8750	1.246	1.709	2.275	2.953	4.689	7.000

TABLE 13

FORMULAS FOR ELEMENTS OF SECTIONS

Figure 1



$$A = d^2$$

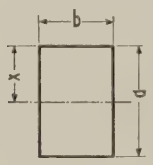
$$x = \frac{d}{2}$$

$$I = \frac{d^4}{12}$$

$$S = \frac{d^3}{6}$$

$$r = \frac{d}{\sqrt{12}} = 0.2887d$$

Figure 4



$$A = bd$$

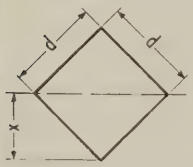
$$x = \frac{d}{2}$$

$$I = \frac{bd^3}{12}$$

$$S = \frac{bd^2}{6}$$

$$r = \frac{d}{\sqrt{12}} = 0.2887d$$

Figure 2



$$A = d^2$$

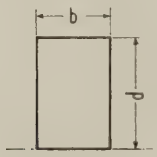
$$x = \frac{d}{\sqrt{2}} = 0.7071d$$

$$I = \frac{d^4}{12}$$

$$S = \frac{\sqrt{2}\,d^3}{12} = 0.1179d^3$$

$$r = \frac{d}{\sqrt{12}} = 0.2887d$$

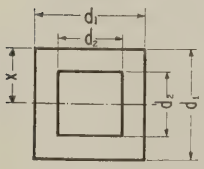
Figure 5



$$A = bd$$

$$I = \frac{bd^3}{3}$$

Figure 3



$$A = d_1^2 - d_2^2$$

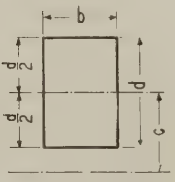
$$x = \frac{d_1}{2}$$

$$I = \frac{d_1^4 - d_2^4}{12}$$

$$S = \frac{d_1^4 - d_2^4}{6d_1}$$

$$r = \sqrt{\frac{d_1^2 + d_2^2}{12}}$$

Figure 6



$$A = bd$$

$$I = A\left(\frac{d^2}{12} + c^2\right)$$

TABLE 13—*Continued*

FORMULAS FOR ELEMENTS OF SECTIONS

Figure 7

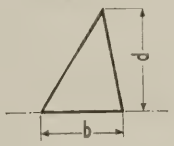
$$A = \frac{bd}{2}$$

$$I = \frac{bd^3}{36}$$

$$S = \frac{bd^2}{24}$$

$$r = \frac{d}{\sqrt{18}} = 0.2357d$$

Figure 8



$$A = \frac{bd}{2}$$

$$I = \frac{bd^3}{12}$$

Figure 9

Regular Polygon

$$a = 2\sqrt{R_1^2 - R_2^2}, \quad \Theta = \frac{180^\circ}{n}$$

n = Number of Sides

$$A = \frac{na^2 \cot \Theta}{4} = \frac{nR_1^2 \sin 2\Theta}{2} = nR_2^2 \tan \Theta$$

$$x_1 = R_1 = \frac{a}{2 \sin \Theta}, \quad x_2 = R_2 = \frac{a}{2 \tan \Theta}$$

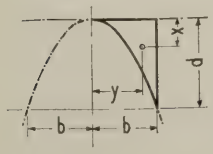
$$I_{1\text{-}1} = I_{2\text{-}2} = \frac{A(6R_1^2 - a^2)}{24} = \frac{A(12R_2^2 + a^2)}{48}$$

$$S_{1\text{-}1} = \frac{A(6R_1^2 - a^2)}{24R_1}, \quad S_{2\text{-}2} = \frac{A(12R_2^2 + a^2)}{48R_2}$$

$$r_{1\text{-}1} = \sqrt{\frac{6R_1^2 - a^2}{24}}, \quad r_{2\text{-}2} = \sqrt{\frac{12R_2^2 + a^2}{48}}$$

Figure 10

Parabola: $y = -ax^2$



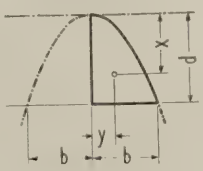
$$A = \frac{bd}{3}$$

$$x = \frac{3d}{10}$$

$$y = \frac{3b}{4}$$

Figure 11

Parabola: $y = -ax^2$



$$A = \frac{2bd}{3}$$

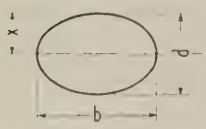
$$x = \frac{6d}{10}$$

$$y = \frac{3b}{8}$$

TABLE 13—*Continued*
FORMULAS FOR ELEMENTS OF SECTIONS

Figure 12

Ellipse



$$A = \frac{\pi bd}{4}$$

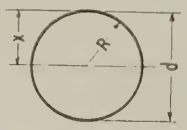
$$x = \frac{d}{2}$$

$$I = \frac{\pi bd^3}{64}$$

$$S = \frac{\pi bd^2}{32}$$

$$r = \frac{d}{4}$$

Figure 13



$$A = \pi R^2 = \frac{\pi d^2}{4}$$

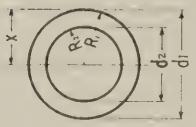
$$x = R = \frac{d}{2}$$

$$I = \frac{\pi R^4}{4} = \frac{\pi d^4}{64}$$

$$S = \frac{\pi R^3}{4} = \frac{\pi d^3}{32}$$

$$r = \frac{R}{2} = \frac{d}{4}$$

Figure 14



$$A = \pi (R_1^2 - R_2^2) = \frac{\pi (d_1^2 - d_2^2)}{4}$$

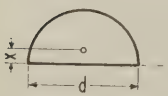
$$x = R_1 = \frac{d_1}{2}$$

$$I = \frac{\pi (R_1^4 - R_2^4)}{4} = \frac{\pi (d_1^4 - d_2^4)}{64}$$

$$S = \frac{\pi (R_1^4 - R_2^4)}{4R_1} = \frac{\pi (d_1^4 - d_2^4)}{32d_1}$$

$$r = \sqrt{\frac{R_1^2 + R_2^2}{4}} = \sqrt{\frac{d_1^2 + d_2^2}{16}}$$

Figure 15

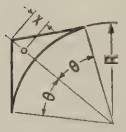


$$A = \frac{\pi R^2}{2} = \frac{\pi d^2}{8}$$

$$I = \frac{\pi R^4}{8} = \frac{\pi d^4}{128}$$

$$x = \frac{4R}{3\pi} = \frac{2d}{3\pi}$$

Figure 16



$$A = (\tan\Theta - \Theta)R^2$$

$$x = \left(\sec\Theta - \frac{\tan^2\Theta \sin\Theta}{3(\tan\Theta - \Theta)}\right)R$$

TECHNICAL DATA
ON
MISCELLANEOUS STRUCTURAL PRODUCTS

TABLE 14

WEIGHTS AND AREAS OF SQUARE AND ROUND BARS

Weights given are for 17S and 25S

For 3S multiply by 0.983—For 51S multiply by 0.965

SIZE inches	SQUARE		ROUND	
	Weight, lb. per ft.	Area, sq. in.	Weight, lb. per ft.	Area, sq. in.
0	0	0	0	0
1/16	0.005	0.0039	0.004	0.0031
1/8	0.019	0.0156	0.015	0.0123
3/16	0.043	0.0352	0.033	0.0276
1/4	0.076	0.0625	0.059	0.0491
5/16	0.118	0.0977	0.093	0.0767
3/8	0.170	0.1406	0.134	0.1104
7/16	0.232	0.1914	0.182	0.1503
1/2	0.303	0.2500	0.238	0.1963
9/16	0.383	0.3164	0.301	0.2485
5/8	0.473	0.3906	0.371	0.3068
11/16	0.572	0.4727	0.449	0.3712
3/4	0.681	0.5625	0.535	0.4418
13/16	0.799	0.6602	0.627	0.5185
7/8	0.926	0.7656	0.728	0.6013
15/16	1.063	0.8789	0.835	0.6903
1	1.210	1.0000	0.950	0.7854
1/16	1.366	1.1289	1.073	0.8866
1/8	1.531	1.2656	1.203	0.9940
3/16	1.706	1.4102	1.340	1.1075
1/4	1.891	1.5625	1.485	1.2272
5/16	2.084	1.7227	1.637	1.3530
3/8	2.288	1.8906	1.797	1.4849
7/16	2.500	2.0664	1.964	1.6230
1/2	2.723	2.2500	2.138	1.7671
9/16	2.954	2.4414	2.320	1.9175
5/8	3.195	2.6406	2.509	2.0739
11/16	3.446	2.8477	2.706	2.2365
3/4	3.706	3.0625	2.910	2.4053
13/16	3.975	3.2852	3.122	2.5802
7/8	4.254	3.5156	3.341	2.7612
15/16	4.542	3.7539	3.567	2.9483
2	4.840	4.0000	3.801	3.1416
1/16	5.147	4.2539	4.043	3.3410
1/8	5.464	4.5156	4.291	3.5466
3/16	5.790	4.7852	4.548	3.7583
1/4	6.126	5.0625	4.811	3.9761
5/16	6.471	5.3477	5.082	4.2000
3/8	6.825	5.6406	5.360	4.4301
7/16	7.189	5.9414	5.646	4.6664
1/2	7.563	6.2500	5.940	4.9087
9/16	7.945	6.5664	6.240	5.1572
5/8	8.338	6.8906	6.548	5.4119
11/16	8.739	7.2227	6.864	5.6727
3/4	9.151	7.5625	7.187	5.9396
13/16	9.571	7.9102	7.517	6.2126
7/8	10.001	8.2656	7.855	6.4918
15/16	10.441	8.6289	8.200	6.7771

TABLE 14—*Continued*

WEIGHTS AND AREAS OF SQUARE AND ROUND BARS

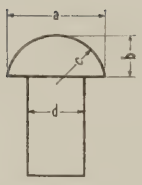
Weights given are for 17S and 25S

For 3S multiply by 0.983—For 51S multiply by 0.965

SIZE inches	SQUARE		ROUND	
	Weight, lb. per ft.	Area, sq. in.	Weight, lb. per ft.	Area, sq. in.
3	10.890	9.0000	8.553	7.0686
1/16	11.348	9.3789	8.913	7.3662
1/8	11.816	9.7656	9.281	7.6699
3/16	12.294	10.1602	9.656	7.9798
1/4	12.781	10.5625	10.038	8.2958
5/16	13.277	10.9727	10.428	8.6180
3/8	13.783	11.3906	10.825	8.9462
7/16	14.298	11.8164	11.230	9.2806
1/2	14.823	12.2500	11.642	9.6212
9/16	15.357	12.6914	12.061	9.9678
5/8	15.900	13.1406	12.488	10.3206
11/16	16.453	13.5977	12.922	10.6796
3/4	17.016	14.0625	13.364	11.0447
13/16	17.588	14.5352	13.813	11.4159
7/8	18.169	15.0156	14.270	11.7933
15/16	18.760	15.5039	14.734	12.1768
4	19.360	16.0000	15.205	12.5664
1/16	19.970	16.5039	15.684	12.9622
1/8	20.589	17.0156	16.171	13.3641
3/16	21.218	17.5352	16.664	13.7721
1/4	21.856	18.0625	17.165	14.1863
5/16	22.503	18.5977	17.674	14.6066
3/8	23.160	19.1408	18.190	15.0330
7/16	23.827	19.6914	18.713	15.4656
1/2	24.503	20.2500	19.244	15.9044
9/16	25.188	20.8164	19.783	16.3492
5/8	25.883	21.3906	20.328	16.8002
11/16	26.587	21.9727	20.881	17.2574
3/4	27.301	22.5625	21.442	17.7206
13/16	28.024	23.1602	22.010	18.1900
7/8	28.756	23.7656	22.585	18.6655
15/16	29.498	24.3789	23.168	19.1472
5	30.250	25.0000	23.758	19.6350
1/16	31.011	25.6289	24.356	20.1289
1/8	31.781	26.2656	24.961	20.6290
3/16	32.561	26.9102	25.574	21.1353
1/4	33.351	27.5625	26.194	21.6476
5/16	34.149	28.2227	26.821	22.1661
3/8	34.958	28.8906	27.456	22.6907
7/16	35.775	29.5664	28.098	23.2215
1/2	36.603	30.2500	28.748	23.7584
9/16	37.439	30.9414	29.405	24.3014
5/8	38.285	31.6406	30.069	24.8505
11/16	39.141	32.3477	30.741	25.4059
3/4	40.006	33.0625	31.420	25.9673
13/16	40.880	33.7852	32.107	26.5349
7/8	41.764	34.5156	32.801	27.1086
15/16	42.657	35.2539	33.503	27.6884

TABLE 15

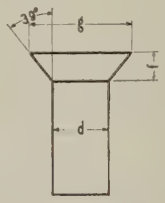
DIMENSIONS OF STRUCTURAL RIVETS



Button Head

GENERAL PROPORTIONS

a=1.75 d
b=0.75 d
c=0.885d
f=0.50 d
g=1.81 d



Countersunk

ALL VALUES GIVEN IN INCHES

Diameter:		1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4
Dimensions	a	0.438	0.547	0.656	0.766	0.875	1.094	1.313	1.531	1.750	1.969	2.188
	b	0.188	0.234	0.281	0.328	0.375	0.469	0.563	0.656	0.750	0.844	0.938
	c	0.221	0.277	0.332	0.387	0.442	0.553	0.664	0.774	0.885	0.995	1.106
	f	0.125	0.156	0.188	0.219	0.250	0.313	0.375	0.438	0.500	0.563	0.625
	g	0.452	0.566	0.679	0.792	0.905	1.131	1.357	1.583	1.810	2.036	2.262

TABLE 16

WEIGHTS OF STRUCTURAL RIVETS

BUTTON HEAD

Weights given are for 17S and 25S
For 3S multiply by 0.983
For 51S multiply by 0.965

VALUES GIVEN IN POUNDS PER HUNDRED RIVETS

Length Under Head inches	DIAMETER IN INCHES										
	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4
0	0.2	0.4	0.6	0.9	1.4	2.8	4.8	7.6	11.3	16.1	22.1
1/2	0.4	...	...	...	...	...	...	...	....	....	....
5/8	0.5	0.9	...	...	...	...	...	...	....	....	....
3/4	0.6	1.0	1.4	...	...	...	...	...	....	....	....
7/8	0.6	1.1	1.6	2.2	...	...	...	...	....	....	....
1	0.7	1.2	1.7	2.4	3.4	...	...	...	....	....	....
1/8	0.8	1.3	1.9	2.6	3.6	...	...	...	....	....	....
1/4	0.8	1.4	2.0	2.8	3.9	7	...	...	....	....	....
3/8	0.9	1.5	2.1	3.0	4.1	7	...	...	....	....	....
1/2	0.9	1.6	2.3	3.2	4.4	7	12	...	....	....	....
5/8	1.0	1.7	2.4	3.4	4.6	8	12	...	....	....	....
3/4	1.1	1.8	2.6	3.6	4.9	8	13	18	....	....	....
7/8	1.1	1.9	2.7	3.8	5.1	9	13	19	....	....	....
2	1.2	2.0	2.8	3.9	5.4	9	14	20	27	....	....
1/8	1.2	2.0	3.0	4.1	5.6	9	14	21	28	....	....
1/4	1.3	2.1	3.1	4.3	5.9	10	15	21	29	39	....
3/8	1.4	2.2	3.3	4.5	6.1	10	15	22	30	40	....
1/2	1.4	2.3	3.4	4.7	6.4	11	16	23	31	41	53
5/8	1.5	2.4	3.5	4.9	6.6	11	17	24	32	42	55
3/4	1.6	2.5	3.7	5.1	6.9	11	17	24	33	44	56
7/8	1.6	2.6	3.8	5.3	7.1	12	18	25	34	45	58
3	1.7	2.7	3.9	5.5	7.3	12	18	26	35	46	59
1/8	1.7	2.8	4.1	5.7	7.6	13	19	27	36	47	61
1/4	1.8	2.9	4.2	5.8	7.8	13	19	27	37	49	62
3/8	1.9	3.0	4.4	6.0	8.1	13	20	28	38	50	64
1/2	1.9	3.1	4.5	6.2	8.3	14	20	29	39	51	65
5/8	2.0	3.2	4.6	6.4	8.6	14	21	30	40	52	67
3/4	2.0	3.3	4.8	6.6	8.8	14	22	30	41	54	69
7/8	2.1	3.4	4.9	6.8	9.1	15	22	31	42	55	70
4	2.2	3.5	5.1	7.0	9.3	15	23	32	43	56	72
1/8	2.2	3.6	5.2	7.2	9.6	16	23	33	44	58	73
1/4	2.3	3.7	5.3	7.4	9.8	16	24	33	45	59	75
3/8	2.4	3.8	5.5	7.6	10.1	16	24	34	46	60	76
1/2	2.4	3.9	5.6	7.7	10.3	17	25	35	47	61	78
5/8	2.5	4.0	5.8	7.9	10.6	17	25	36	48	63	79
3/4	2.5	4.1	5.9	8.1	10.8	18	26	36	49	64	81
7/8	2.6	4.2	6.0	8.3	11.1	18	27	37	50	65	82
5	2.7	4.3	6.2	8.5	11.3	18	27	38	51	66	84

TABLE 17

SAFE SHEARING AND BEARING VALUES FOR STRUCTURAL RIVETS

VALUES GIVEN IN POUNDS

17ST RIVETS IN ALUMINUM STRUCTURES

Diameter, in.		1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4
Area, sq. in.		0.0491	0.0767	0.1104	0.1503	0.1963	0.3068	0.4418	0.6013	0.7854	0.9940	1.2272
Single Shear Value @ 9000 lb. per sq. in.		440	690	990	1350	1770	2760	3980	5410	7070	8950	11050
Double Shear Value @ 9000 lb. per sq. in.		880	1380	1980	2700	3540	5520	7960	10820	14140	17900	22100
BEARING VALUES For Various Thicknesses of Material	1/16	300	370	450	....	....	....	....	....	....	....	....
	1/8	590	740	890	1040	1190	1480	....	....	....	....	....
	3/16	890	1110	1340	1560	1780	2230	....	....	....	....	....
	1/4	1190	1480	1780	2080	2380	2970	3560	4160	4750	5340	5940
	5/16	....	1860	2230	2600	2970	3710	4450	5200	5940	6680	7420
	3/8	....	....	2670	3120	3560	4450	5340	6230	7130	8020	8910
	7/16	....	....	....	3640	4160	5200	6230	7270	8310	9350	10390
	1/2	....	....	....	....	4750	5940	7130	8310	9500	10690	11880
	9/16	....	....	....	....	....	6680	8020	9350	10690	12020	13360
	5/8	....	....	....	....	....	7420	8910	10390	11880	13360	14840
	11/16	....	....	....	....	....	....	9800	11430	13060	14700	16330
	3/4	....	....	....	....	....	....	10690	12470	14250	16030	17810
	7/8	....	....	....	....	....	....	....	14550	16630	18700	20780
	1	....	....	....	....	....	....	....	....	19000	21380	23750

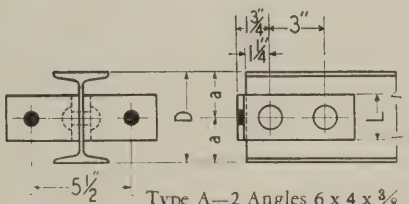
Values Given are for 17ST and 25ST Structures @ 19,000 lb. per sq. in.
For 3SO Multiply by 0.21
For 3S½H Multiply by 0.37
For 3SH Multiply by 0.53
For 51SW Multiply by 0.58
For 51ST Multiply by 0.84

STEEL RIVETS IN ALUMINUM STRUCTURES—Bearing Values are the Same as for 17ST Rivets Above

Single Shear Value @ 12,000 lb. per sq. in.	590	920	1320	1800	2360	3680	5300	7220	9420	11930	14730
Double Shear Value @ 12,000 lb. per sq. in.	1180	1840	2640	3600	4720	7360	10600	14440	18840	23860	29460

SUGGESTED END CONNECTIONS FOR ALUMINUM BEAMS

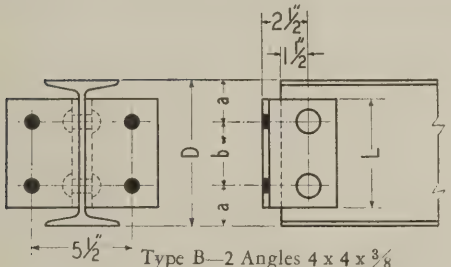
See Tables on Pages 92 and 93 for Data on These Joints



Type A—2 Angles 6 x 4 x 3/8

D in.	L in.	a in.	Max.* Rivet
3	1½	1½	½
4	2½	2	¾
5	2½	2½	¾

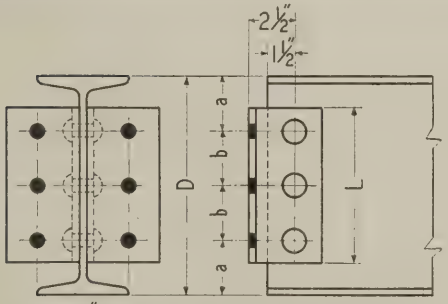
*Larger rivets can be used by altering details.



Type B—2 Angles 4 x 4 x 3/8

D in.	L in.	a in.	b in.	Max.* Rivet
5	3½	1½	2	½
6	4½	1⅞	2¼	¾
7	5	2¼	2½	¾
8	6	2¼	3½	¾

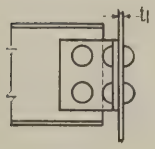
*Larger rivets can be used by altering details.



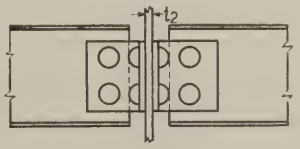
Type C—2 Angles 4 x 4 x 3/8

D in.	L in.	a in.	b in.	Max.* Rivet
9	7	2¼	2¼	¾
10	7½	2½	2½	¾
12	8½	3	3	¾

*Larger rivets can be used by altering details.



Case I



Case II

TABLE 18A

DATA FOR BEAM CONNECTIONS

USING 17ST RIVETS

The Maximum Safe Reactions on the Connections are for 17ST and 25ST Beams Based on the Design Stresses Given in Table 4. Simple Beam Bending Moment Assumed.

The Weights of the Connections Represent the Total Weight Added to the Beams by the Angles and Rivets Shown in the Drawing on Page 91.

t_1 is the Minimum Thickness of 17ST or 25ST Material Required to Develop the Indicated Maximum Reaction for Case I. t_2 is Same for Case II.

Type	Beam		½ In. Rivets				¾ In. Rivets			
	Depth inches	Web Thickness inches	Max. Safe Reaction pounds	t_1 in.	t_2 in.	Weight pounds	Max. Safe Reaction pounds	t_1 in.	t_2 in.	Weight pounds
A	3	0.170	1000	0.06	0.11	1.1	....	....	....	...
		0.251	1500	0.08	0.16	1.1	....	....	....	...
		0.349	2100	0.11	0.22	1.1	....	....	....	...
	4	0.190	1100	0.06	0.12	1.9	1700	0.06	0.12	2.0
		0.253	1500	0.08	0.16	1.9	2300	0.08	0.16	2.0
		0.326	2000	0.11	0.21	1.9	2900	0.11	0.21	2.0
		0.400	2400	0.13	0.25	1.9	3600	0.13	0.25	2.0
	5	0.210	1300	0.07	0.14	1.9	1900	0.07	0.14	2.0
		0.347	2100	0.11	0.22	1.9	3100	0.11	0.22	2.0
		0.494	3000	0.16	0.32	1.9	4400	0.16	0.32	2.0
B	5	0.210	1480	0.04	0.08	2.0	....	....	....	...
		0.347	2440	0.06	0.12	2.0	....	....	....	. .
		0.494	2620	0.07	0.14	2.0	....	....	....	...
	6	0.230	1780	0.05	0.10	2.6	2660	0.05	0.10	2.7
		0.343	2650	0.07	0.14	2.6	3980	0.07	0 14	2.7
		0.465	2880	0.08	0.16	2.6	5390	0.09	0.18	2.7
	7	0.250	2120	0.06	0.12	2.9	3180	0.06	0.12	3.0
		0.345	2930	0.08	0.16	2.9	4380	0.08	0.16	3.0
		0.450	3160	0.08	0.16	2.9	5720	0.10	0.20	3.0
	8	0.270	2960	0.08	0.16	3.5	4420	0.08	0.16	3.6
		0.349	3820	0.10	0.20	3.5	5710	0.10	0.20	3.6
		0.441	4070	0.11	0.22	3.5	7230	0.13	0.26	3.6
		0.532	4070	0.11	0.22	3.5	8700	0.15	0.30	3.6
C	9	0.290	4260	0.07	0.14	4.1	6390	0.07	0.14	4.2
		0.397	5480	0.10	0.20	4.1	8750	0.10	0.20	4.2
		0.561	5480	0.10	0.20	4.1	12300	0.14	0.28	4.2
	10	0.310	4930	0.09	0.18	4.4	7350	0.09	0.18	4 5
		0.447	5910	0.10	0.20	4.4	10600	0.12	0.24	4.5
		0.594	5910	0.10	0.20	4.4	13300	0.16	0.32	4.5
	12	0.350	6240	0.11	0.22	5.0	9320	0.11	0.22	5.1
		0.428	6620	0.12	0.24	5.0	11420	0.13	0.26	5.1
		0.460	6620	0.12	0.24	5.0	12250	0.14	0.28	5.1
		0.565	6620	0.12	0.24	5.0	14900	0.17	0.34	5.1
		0.687	6620	0.12	0.24	5.0	14900	0.17	0.34	5.1

TABLE 18B

DATA FOR BEAM CONNECTIONS

USING STEEL RIVETS

The Maximum Safe Reactions on the Connections are for 17ST and 25ST Beams Based on the Design Stresses Given in Table 4. Simple Beam Bending Moment Assumed.

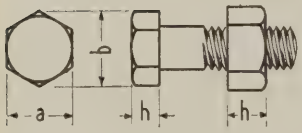
The Weights of the Connections Represent the Total Weight Added to the Beams by the Angles and Rivets Shown in the Drawing on Page 91.

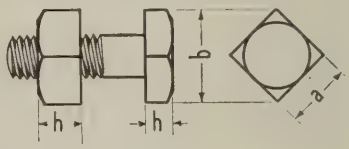
t_1 is the Minimum Thickness of 17ST or 25ST Material Required to Develop the Indicated Maximum Reaction for Case I. t_2 is Same for Case II.

Type	Beam		½ In. Rivets				¾ In. Rivets			
	Depth inches	Web Thickness inches	Max. Safe Reaction pounds	t_1 in.	t_2 in.	Weight pounds	Max. Safe Reaction pounds	t_1 in.	t_2 in.	Weight pounds
A	3	0.170	1000	0.06	0.11	1.3	....	....	....	...
		0 251	1500	0.08	0.16	1.3	....	....	....	...
		0.349	2100	0.11	0.22	1.3	....	....	....	...
	4	0.190	1100	0.06	0.12	2.1	1700	0.06	0.12	2.6
		0 253	1500	0.08	0.16	2.1	2300	0.08	0.16	2.6
		0.326	2000	0.11	0.21	2.1	2900	0.11	0.21	2.6
		0.400	2400	0.13	0.25	2.1	3600	0.13	0.25	2.6
	5	0.210	1300	0.07	0.14	2.1	1900	0.07	0.14	2.6
		0.347	2100	0.11	0.22	2.1	3100	0.11	0.22	2.6
		0.494	3000	0.16	0.32	2.1	4400	0.16	0.32	2.6
B	5	0.210	1480	0.04	0.08	2.3	....	....	....	...
		0.347	2440	0.06	0.12	2.3	....	....	....	...
		0.494	3480	0.09	0.18	2.3	...	...	....	...
	6	0.230	1780	0.05	0.10	2.8	2660	0.05	0.10	3.4
		0.343	2650	0.07	0.14	2.8	3980	0.07	0.14	3.4
		0.465	3590	0.09	0.18	2.8	5390	0.09	0.18	3.4
	7	0.250	2120	0.06	0.12	3.1	3180	0.06	0.12	3.6
		0.345	2930	0.08	0.16	3.1	4380	0.08	0.16	3.6
		0 450	3820	0.10	0.20	3.1	5720	0.10	0.20	3.7
	8	0.270	2960	0.08	0.16	3.7	4420	0.08	0.16	4.2
		0.349	3820	0.10	0.20	3.7	5710	0.10	0.20	4.2
		0.441	4820	0.13	0.26	3.7	7230	0.13	0.26	4.3
		0.532	5420	0.14	0.28	3.7	8700	0.15	0.30	4.3
C	9	0.290	4260	0.07	0.14	4.4	6390	0.07	0.14	5.2
		0.397	5830	0.10	0.20	4.4	8750	0.10	0.20	5.2
		0.561	7300	0.13	0.26	4.4	12380	0.14	0.28	5.2
	10	0.310	4930	0.09	0.18	4.7	7350	0.09	0.18	5.5
		0.447	7090	0.12	0.24	4.7	10600	0.12	0.24	5.5
		0.594	7880	0.14	0.28	4.7	14100	0.16	0.32	5.5
	12	0.350	6240	0.11	0.22	5.3	9320	0.11	0.22	6.1
		0.428	7600	0.13	0.26	5.3	11420	0.13	0.26	6.1
		0.460	8160	0.14	0.28	5.3	12250	0.14	0.28	6.1
		0.565	8830	0.15	0.30	5.3	15100	0.18	0.36	6.1
		0.687	8830	0.15	0.30	5.3	18400	0.21	0.42	6.2

TABLE 19

DIMENSIONS OF ROUGH AND SEMI-FINISHED BOLTS





All Dimensions in Inches

Diameter of Bolt	Threads per Inch	SHANK			HEAD					NUT				
		Diameter at Root of Thread	Gross Area in Shank sq. in.	Area at Root of Thread sq. in.	Hexagonal		Hex. or Square	Square		Hexagonal		Hex. or Square	Square	
					a	b	h	a	b	a	b	h	a	b
1/4	20	0.1850	0.049	0.027	3/8	0.43	11/64	3/8	0.53	7/16	0.51	7/32	7/16	0.62
5/16	18	0.2403	0.077	0.045	1/2	0.58	13/64	1/2	0.71	9/16	0.55	17/64	9/16	0.80
3/8	16	0.2938	0.111	0.068	9/16	0.65	1/4	9/16	0.80	5/8	0.72	21/64	5/8	0.88
7/16	14	0.3447	0.150	0.093	5/8	0.72	19/64	5/8	0.88	3/4	0.87	3/8	3/4	1.06
1/2	13	0.4001	0.196	0.126	3/4	0.87	21/64	3/4	1.06	13/16	0.94	7/16	13/16	1.15
9/16	12	0.4542	0.249	0.162	7/8	1.01	3/8	7/8	1.24	7/8	1.01	1/2	7/8	1.24
5/8	11	0.5069	0.307	0.202	15/16	1.08	27/64	15/16	1.33	15/16	1.08	35/64	15/16	1.33
3/4	10	0.6201	0.442	0.302	1 1/8	1.30	1/2	1 1/8	1.59	1 1/8	1.30	21/32	1 1/8	1.59
7/8	9	0.7307	0.601	0.419	1 5/16	1.52	19/32	1 5/16	1.86	1 5/16	1.52	49/64	1 5/16	1.86
1	8	0.8376	0.785	0.551	1 1/2	1.73	21/32	1 1/2	2.12	1 1/2	1.73	7/8	1 1/2	2.12
1 1/8	7	0.9394	0.994	0.693	1 11/16	1.95	3/4	1 11/16	2.39	1 11/16	1.95	1	1 11/16	2.39
1 1/4	7	1.0644	1.227	0.890	1 7/8	2.17	27/32	1 7/8	2.65	1 7/8	2.17	1 3/32	1 7/8	2.65

TABLE 20

SIZES AND WEIGHTS OF 17ST NAILS

TYPE	SIZE	Length inches	Diameter of Shank inches	Diameter of Head inches	Weight per Keg lb.	Number per Keg
Roofing Nails	....	3/4	0.091	0.273	33.4	70500
Roofing Nails	....	7/8	0.105	0.315	33.4	46900
Roofing Nails	....	1	0.105	0.315	33.4	41100
Roofing Nails	....	1 1/8	0.105	0.315	33.4	36500
Roofing Nails	....	1 1/4	0.121	0.363	33.4	25100
Roofing Nails	....	1 3/8	0.121	0.363	33.4	23000
Roofing Nails	....	1 1/2	0.135	0.405	33.4	17600
Roofing Nails	....	1 3/4	0.135	0.405	33.4	15100
Roofing Nails	....	2	0.148	0.444	33.4	10300
Shingle Nails	3d	1 1/4	0.091	0.219	33.4	43000
Shingle Nails	3 1/2d	1 3/8	0.098	0.250	33.4	34500
Shingle Nails	4d	1 1/2	0.105	0.250	33.4	27400
Slating Nails	2d	1	0.105	0.312	33.4	41200
Slating Nails	3d	1 1/4	0.128	0.375	33.4	22550
Slating Nails	4d	1 1/2	0.128	0.375	33.4	18650
Slating Nails	5d	1 3/4	0.135	0.409	33.4	14200
Slating Nails	6d	2	0.148	0.437	33.4	10300

TABLE 21

DIMENSIONS AND ELEMENTS OF SECTIONS OF PIPE

Weights given are for 17S and 25S

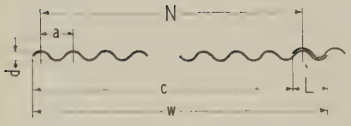
For 3S Multiply by 0.983—For 51S Multiply by 0.965

	Size inches	Diameter, inches		Thickness inches	Cross-Sectional Area of Wall sq. in.	Weight lb. per lin. ft.	Moment of Inertia inches^4	Radius of Gyration inches
		Inside	Outside					
Standard Pipe	⅛	0.269	0.405	0.068	0.0719	0.0870	0.0011	0.124
	¼	0.364	0.540	0.088	0.1250	0.1513	0.0033	0.163
	⅜	0.493	0.675	0.091	0.1670	0.2021	0.0073	0.209
	½	0.622	0.840	0.109	0.2503	0.3029	0.0171	0.261
	¾	0.824	1.050	0.113	0.3326	0.4024	0.0370	0.334
	1	1.049	1.315	0.133	0.4939	0.5976	0.0874	0.421
	1¼	1.380	1.660	0.140	0.6685	0.8089	0.1948	0.540
	1½	1.610	1.900	0.145	0.7995	0.9674	0.3100	0.623
	2	2.067	2.375	0.154	1.0745	1.3001	0.6659	0.787
	2½	2.469	2.875	0.203	1.7040	2.0618	1.5300	0.948
	3	3.068	3.500	0.216	2.2285	2.6965	3.0179	1.164
	3½	3.548	4.000	0.226	2.6795	3.2422	4.7889	1.337
	4	4.026	4.500	0.237	3.1740	3.8405	7.2345	1.510
	4½	4.506	5.000	0.247	3.6882	4.4627	10.4458	1.683
	5	5.047	5.563	0.258	4.2999	5.2029	15.1661	1.878
	6	6.065	6.625	0.280	5.5814	6.7535	28.1494	2.246
	7	7.023	7.625	0.301	6.9257	8.3801	46.5187	2.592
	8	7.981	8.625	0.322	8.3992	10.1630	72.4927	2.938
Extra Heavy Pipe	⅛	0.215	0.405	0.095	0.0925	0.1119	0.0012	0.114
	¼	0.302	0.540	0.119	0.1574	0.1905	0.0038	0.155
	⅜	0.423	0.675	0.126	0.2173	0.2629	0.0086	0.199
	½	0.546	0.840	0.147	0.3201	0.3873	0.0201	0.251
	¾	0.742	1.050	0.154	0.4335	0.5245	0.0448	0.321
	1	0.957	1.315	0.179	0.6388	0.7729	0.1056	0.407
	1¼	1.278	1.660	0.191	0.8815	1.0666	0.2419	0.524
	1½	1.500	1.900	0.200	1.0681	1.2924	0.3913	0.605
	2	1.939	2.375	0.218	1.4773	1.7875	0.8681	0.767
	2½	2.323	2.875	0.276	2.2535	2.7267	1.9247	0.924
	3	2.900	3.500	0.300	3.0159	3.6492	3.8953	1.137
	3½	3.364	4.000	0.318	3.6784	4.4509	6.2817	1 307
	4	3.826	4.500	0.337	4.4074	5.3330	9.6130	1.477
	4½	4.290	5.000	0.355	5.1804	6.2683	14.0568	1.647
	5	4.813	5.563	0.375	6.1120	7.3955	20.6760	1.839
	6	5.761	6.625	0.432	8.4050	10.1701	40.5011	2.195
	7	6.625	7.625	0.500	11.1920	13.5423	71.3741	2.525
	8	7.625	8.625	0.500	12.7628	15.4430	105.7218	2.878

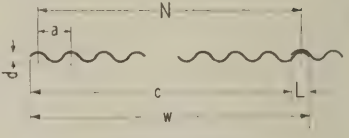
TABLE 22

DIMENSIONS OF CORRUGATED SHEETS

Nominal Pitch, 2½ Inches



ROOFING SHEET



SIDING SHEET

Type	Width	No. of Corrugations N	Overall Width w in.	Covering Width c in.	Actual Pitch a in.	Depth d in.	Side Lap L in.	End Lap in.
Roofing	Standard	9	27	24	2.67	¾	3	6
	Extra Wide	14	40¼	37¼	2.66	¾	3	6
Siding	Standard	9	25½	24	2.67	¾	1½	4
	Extra Wide	14	38¾	37¼	2.66	¾	1½	4

TABLE 23

WEIGHTS OF CORRUGATED SHEETS

Nominal Pitch, 2½ Inches

Width	Type	Gage B&S	Weight lb. per lin. ft.	Weight lb. per sq. ft.	Total Weight of One Sheet in Pounds For Various Standard Lengths							
					5 ft.	6 ft.	7 ft.	8 ft.	9 ft.	10 ft.	11 ft.	12 ft.
STANDARD	ROOFING	14	2.46	1.09	12.29	14.75	17.20	19.65	22.12	24.58	27.04	29.50
		16	1.95	0.87	9.74	11.69	13.64	15.59	17.53	19.49	21.43	23.38
		18	1.55	0.67	7.75	9.30	10.86	12.40	13.92	15.50	17.05	18.60
		20	1.24	0.55	6.17	7.40	8.64	9.86	11.10	12.35	13.57	14.81
		22	0.98	0.43	4.89	5.87	6.85	7.83	8.81	9.78	10.77	11.75
	SIDING	14	2.34	1.09	11.68	14.01	16.35	18.69	21.02	23.36	25.69	28.03
		16	1.86	0.87	9.28	11.14	12.99	14.85	16.70	18.56	20.42	22.28
		18	1.47	0.67	7.34	8.83	10.30	11.75	13.22	14.69	16.16	17.62
		20	1.17	0.55	5.85	7.04	8.21	9.38	10.56	11.73	12.90	14.08
		22	0.93	0.43	4.66	5.59	6.52	7.52	8.37	9.30	10.23	11.16
EXTRA WIDE	ROOFING	14	3.69	1.09	18.45	22.13	25.85	29.54	33.23	36.92	40.62	44.31
		16	2.93	0.87	14.65	17.54	20.40	23.42	26.35	29.27	32.20	35.13
		18	2.33	0.67	11.63	13.95	16.28	18.60	20.93	23.26	25.58	27.91
		20	1.85	0.55	9.23	11.08	12.92	14.76	16.62	18.45	20.31	22.15
		22	1.47	0.43	7.34	8.81	10.28	11.75	13.22	14.69	16.16	17.63
	SIDING	14	3.58	1.09	17.80	22.01	25.06	28.64	32.22	35.80	39.38	42.96
		16	2.85	0.87	14.23	17.08	19.92	22.77	25.61	28.46	31.31	34.15
		18	2.25	0.67	11.27	13.53	15.78	18.03	20.29	22.54	24.80	27.05
		20	1.80	0.55	8.98	10.77	12.57	14.36	16.16	17.95	19.75	21.54
		22	1.43	0.43	7.14	8.57	10.00	11.42	12.85	14.28	15.71	17.14

TABLE 24

SAFE UNIFORMLY DISTRIBUTED LOAD ON 2½ INCH CORRUGATED SHEET

Gage B&S	Thickness inches	Safe Load for Various Span Lengths in pounds per square foot								
		24 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.	66 in.	72 in.
14	.0641	288	185	129	95	72	57	46	38	32
16	.0508	228	147	102	75	57	45	37	30	25
18	.0403	181	117	81	59	45	36	29	24	20
20	.0320	144	92	64	47	36	29	23	19	16
22	.0253	114	73	50	37	28	23	18	15	13

TABLE 25

ALUMINUM SHINGLES

Aluminum shingles and accessories are furnished in the sizes shown below and in the following colors: "Natural Aluminum" (unpainted); "Standard Green"; "Light Green"; "Dark Green"; "Gray"; and "Terra Cotta Red".

DESCRIPTION	Size to Weather inches	Gage B&S	Weight Each pounds	Number per 100 sq. ft.	Weight per 100 sq. ft. pounds
Full-Size Regular	8 x 16	24	0.5	112.5	54
Full-Size Starter	8 x 16	24	0.5	112.5	54
¾-Size Starter	8 x 12	24	0.39	112.5	54
¾-Size Finisher	8 x 12	24	0.39	112.5	54

TABLE 26

ALUMINUM ROOFING ACCESSORIES

ITEM	Finish Design*	Length inches	Gage B&S	Weight Each pounds
Eave Finishers	P-R-T	42	22	0.47
Valley Sheets (formed)	P-R-T	72	22	3.25
Ridge Flashing	P-R-T	36	22	0.28
Valley Flashing	P-R-T	36	22	0.31
Flashing Sheets—18" Wide	P-R-T	96	22	4.22
Flashing Sheets—20" Wide	P-R-T	96	22	5.00
Side Finish Pieces:				
Right Hand	P-R	9¼	24	0.062
Left Hand	P-R	9¼	24	0.062
Right and Left Hand	T-(only)	9¼	24	0.062
Ridge Cover	P-(only)	16	24	0.375
Ridge Cover	R-(only)	24	24	0.53
Ridge Cover	T-(only)	16	24	0.375
Hip Cover	P-(only)	12	22	0.22
Hip Cover	R-(only)	12	22	0.22
Hip Cover	T-(only)	12	22	0.22

*P-Plain, R-Ribbed, T-Texture.

CONVERSION TABLES AND OTHER USEFUL DATA

USEFUL CONVERSION FACTORS

One board foot	= 144	cubic inches
One centimeter	= 0.3937	inches
One centimeter	= 0.01	meters
One centimeter	= 10	millimeters
One cubic centimeter	= 3.531×10^{-5}	cubic feet
One cubic centimeter	= 0.06102	cubic inches
One cubic foot	= 28317	cubic cms.
One cubic foot	= 1728	cubic inches
One cubic foot	= 7.481	gallons
One cubic foot	= 28.32	liters
One cubic inch	= 16.39	cubic cms.
One degree (angle)	= 0.01745	radians
One foot per second	= 0.6818	miles per hour
One gallon	= 231	cubic inches
One gallon	= 3.785	liters
One gram	= 2.205×10^{-3}	pounds
One gram per cu. cm.	= 62.43	pounds per cubic foot
One horse power	= 550	foot-pounds per second
One horse power	= 0.7457	kilowatts
One inch	= 2.540	centimeters
One kilogram	= 1000	grams
One kilogram	= 2.205	pounds
One kilogram per sq. mm.	= 1422	pounds per square inch
One mile	= 5280	feet
One pound	= 453.6	grams
One pound per sq. in.	= 0.068	atmospheres
One pound per sq. in.	= 2.307	feet of water
One pound per sq. in.	= 2.036	inches of mercury
One pound per sq. in.	= 7.031×10^{-4}	kilograms per sq. mm.
One radian	= 57.30	degrees
One square inch	= 6.452	square cms.
One ton (long)	= 2240	pounds
One ton (long) per sq. in.	= 1.575	kilograms per sq. mm.

TABLE 27—FRACTIONS TO DECIMALS

FRACTIONS	DECIMALS	FRACTIONS	DECIMALS
1/64	.015625	33/64	.515625
1/32	.03125	17/32	.53125
3/64	.046875	35/64	.546875
1/16	.0625	9/16	.5625
5/64	.078125	37/64	.578125
3/32	.09375	19/32	.59375
7/64	.109375	39/64	.609375
1/8	.125	5/8	.625
9/64	.140625	41/64	.640625
5/32	.15625	21/64	.65625
11/64	.171875	43/64	.671875
3/16	.1875	11/16	.6875
13/64	.203125	45/64	.703125
7/32	.21875	23/32	.71875
15/64	.234375	47/64	.734375
1/4	.25	3/4	.75
17/64	.265625	49/64	.765625
9/32	.28125	25/32	.78125
19/64	.296875	51/64	.796875
5/16	.3125	13/16	.8125
21/64	.328125	53/64	.828125
11/32	.34375	27/32	.84375
23/64	.359375	55/64	.859375
3/8	.375	7/8	.875
25/64	.390625	57/64	.890625
13/32	.40625	29/32	.90625
27/64	.421875	59/64	.921875
7/16	.4375	15/16	.9375
29/64	.453125	61/64	.953125
15/32	.46875	31/32	.96875
31/64	.484375	63/64	.984375
1/2	.5	1	1.0

TABLE 28—INCHES TO DECIMALS OF A FOOT

	0	1	2	3	4	5	6	7	8	9	10	11
0	0	.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167
1/16	.0052	.0885	.1719	.2552	.3385	.4219	.5052	.5885	.6719	.7552	.8385	.9219
1/8	.0104	.0938	.1771	.2604	.3438	.4271	.5104	.5938	.6771	.7604	.8438	.9271
3/16	.0156	.0990	.1823	.2656	.3490	.4323	.5156	.5990	.6823	.7656	.8490	.9323
1/4	.0208	.1042	.1875	.2708	.3542	.4375	.5208	.6042	.6875	.7708	.8542	.9375
5/16	.0260	.1094	.1927	.2760	.3594	.4427	.5260	.6094	.6927	.7760	.8594	.9427
3/8	.0313	.1146	.1979	.2813	.3646	.4479	.5313	.6146	.6979	.7813	.8646	.9479
7/16	.0365	.1198	.2031	.2865	.3698	.4531	.5365	.6198	.7031	.7865	.8698	.9531
1/2	.0417	.1250	.2083	.2917	.3750	.4583	.5417	.6250	7083	.7917	.8750	.9583
9/16	.0469	.1302	.2135	.2969	.3802	.4635	.5469	.6302	.7135	.7969	.8802	.9635
5/8	.0521	.1354	.2188	.3021	.3854	.4688	.5521	.6354	.7188	.8021	.8854	.9688
11/16	.0573	.1406	.2240	.3073	.3906	.4740	.5573	.6406	.7240	8073	.8906	.9740
3/4	.0625	.1458	.2292	.3125	.3958	.4792	.5625	.6458	.7292	.8125	.8958	.9792
13/16	.0677	.1510	.2344	.3177	.4010	.4844	.5677	.6510	.7344	.8177	.9010	.9844
7/8	.0729	.1563	.2396	.3229	.4063	.4896	.5729	.6563	.7396	.8229	.9063	.9896
15/16	.0781	.1615	.2448	.3281	.4115	4948	.5781	.6615	.7448	.8281	9115	.9948

TABLE 29

INCHES TO CENTIMETERS

One Foot = 30.480 Centimeters

	0	1	2	3	4	5	6	7	8	9	10	11
0	0	2.540	5.080	7.620	10.160	12.700	15.240	17.780	20.320	22.860	25.400	27.940
1/32	0.079	2.619	5.159	7.699	10.239	12.779	15.319	17.859	20.399	22.939	25.479	28.019
1/16	0.159	2.699	5 239	7.779	10.319	12.859	15.399	17.939	20.479	23.019	25.559	28.099
3/32	0.238	2.778	5.318	7.858	10.398	12.938	15.478	18.018	20.558	23.098	25.638	28.178
1/8	0.318	2 858	5.398	7 938	10.478	13.018	15.558	18.098	20.638	23.178	25.718	28.258
5/32	0 397	2.937	5.477	8.017	10.557	13.097	15.637	18.177	20.717	23.257	25.797	28.337
3/16	0 476	3.016	5.556	8.096	10.636	13.176	15.716	18.256	20.796	23 336	25.876	28.416
7/32	0.556	3.096	5.636	8.176	10.716	13.256	15 796	18.336	20.876	23.416	25.956	28.496
1/4	0.635	3.175	5.715	8.255	10.795	13.335	15.875	18.415	20.955	23.495	26.035	28.575
9/32	0.714	3.254	5.794	8.334	10.874	13.414	15.954	18.494	21.034	23.574	26.114	28.654
5/16	0.794	3.334	5 874	8.414	10.954	13.494	16.034	18.574	21.114	23.654	26.194	28.734
11/32	0.873	3.413	5.953	8.493	11.033	13.573	16.113	18.653	21.193	23.733	26.273	28.813
3/8	0.953	3.493	6.033	8.573	11.113	13.653	16.193	18.733	21.273	23.813	26.353	28.893
13/32	1.032	3.572	6.112	8.652	11.192	13.732	16.272	18.812	21.352	23.892	26.432	28.972
7/16	1.111	3.651	6.191	8.731	11.271	13.811	16.351	18.891	21.431	23.971	26.511	29.051
15/32	1.191	3 731	6.271	8.811	11.351	13.891	16.431	18.971	21.511	24.051	26.591	29.131
1/2	1.270	3.810	6.350	8.890	11.430	13.970	16.510	19.050	21.590	24.130	26.670	29.210
17/32	1.349	3.889	6.429	8.969	11.509	14.049	16.589	19.129	21.669	24.209	26.749	29.289
9/16	1.429	3.969	6.509	9.049	11.589	14.129	16.669	19.209	21.749	24.289	26.829	29.369
19/32	1.508	4.048	6.588	9.128	11.668	14.208	16.748	19.288	21.828	24.368	26.908	29.448
5/8	1.588	4.128	6.668	9.208	11.748	14.288	16.828	19.368	21.908	24.448	26.988	29.528
21/32	1.667	4.207	6.747	9.287	11.827	14.367	16.907	19.447	21.987	24.527	27.067	29.607
11/16	1.746	4.286	6.826	9.366	11.906	14.446	16.986	19.526	22.066	24.606	27.146	29.686
23/32	1.826	4.366	6.906	9.446	11.986	14.526	17.066	19.606	22.146	24.686	27.226	29.766
3/4	1.905	4.445	6.985	9.525	12.065	14.605	17.145	19.685	22.225	24.765	27.305	29.845
25/32	1.984	4.524	7.064	9.604	12.144	14.684	17.224	19.764	22.304	24.844	27.384	29 924
13/16	2 064	4.604	7.144	9.684	12.224	14.764	17.304	19.844	22.384	24.924	27.464	30.004
27/32	2.143	4.683	7.223	9.763	12.303	14.843	17.383	19.923	22.463	25.003	27.543	30.083
7/8	2.223	4.763	7.303	9 843	12.383	14.923	17.463	20.003	22.543	25.083	27.623	30.163
29/32	2.302	4.842	7.382	9 922	12.462	15.002	17.542	20.082	22.622	25.162	27.702	30.242
15/16	2.381	4.921	7.461	10.001	12.541	15.081	17.621	20.161	22.701	25.241	27.781	30.321
31/32	2.461	5.001	7.541	10.081	12.621	15.161	17.701	20.241	22.781	25.321	27.861	30.401

TABLE 30

SHEET AND TUBE GAGES

Number	Thickness in inches		Number	Thickness in inches		Number	Thickness in inches	
	B&S Gage Sheet	Stubs Gage Tubing		B&S Gage Sheet	Stubs Gage Tubing		B&S Gage Sheet	Stubs Gage Tubing
00	.365	.380	11	.091	.120	23	.023	.025
0	.325	.340	12	.081	.109	24	.020	.022
1	.289	.300	13	.072	.095	25	018	.020
2	.258	.284	14	.064	.083	26	.016	.018
3	.229	.259	15	.057	.072	27	.014	.016
4	.204	.238	16	.051	.065	28	.013	.014
5	.182	.220	17	.045	.058	29	.011	.013
6	.162	.203	18	.040	.049	30	.010	.012
7	.144	.180	19	.036	.042	31	.009	.010
8	.128	.165	20	.032	.035	32	.008	.009
9	.114	.148	21	.028	.032	33	.007	.008
10	.102	.134	22	.025	.028	34	.006	.007

TABLE 31

TYPICAL PROPERTIES OF WROUGHT ALUMINUM ALLOYS

Alloy and Temper	Weight lb. per cu. ft.	††Yield Point lb. per sq. in.	††Tensile Strength lb. per sq. in.	††Elongation in 2 in. per cent	Shear Strength lb. per sq. in.	Coef. of Expansion per Degree F. 68°-212°F.	Thermal Conductivity at 100°C. *	Electrical Conductivity at 20°C. †
2SO	169	4000	13000	40	10000	0.000013	.53	59
2S½H	169	14000	17000	20	11000	0.000013	. . .	. .
2SH	169	21000	24000	10	13000	0.000013	. . .	57
3SO	171	5000	16000	40	11000	0.000013	.45	50
3S½H	171	18000	21000	20	13000	0.000013	. . .	. .
3SH	171	25000	30000	10	16000	0.000013	. . .	40
17SO	174	10000	26000	20	18000	0.000012	.40	45
17ST	174	35000	58000	20	35000	0.000012	.27	30
Alclad 17ST	174	33000	53000	20	35000	0.000012	. . .	. .
25SO	174	10000	26000	20	18000	0.000012	.45	50
25SW	174	25000	48000	18	30000	0.000012	. . .	35
25ST	174	35000	58000	20	35000	0.000012	. . .	35
51SO	168	6000	16000	30	11000	0.000012	.50	55
51SW	168	20000	35000	24	24000	0 000012	. . .	45
51ST	168	35000	48000	14	30000	0 000012	. . .	45

*Values given are approximate. (Calories per cm. cube per sec. per degree C.)
†Volume Conductivity in per cent based on 100 for copper. (Annealed Copper Std.)
††For specification values consult nearest sales office of the Company.

TABLE 32

TYPICAL PROPERTIES OF CAST ALUMINUM ALLOYS

Values Obtained on Sand Cast Specimens

Alloy and Temper	Weight lb. per cu. ft.	††Yield Point lb. per sq.in.	††Tensile Strength lb. per sq. in.	††Elongation in 2 in. per cent	Shear Strength lb. per sq. in.	Coef. of Expansion per Degree F. 68°-212°F.	Thermal Conductivity at 100°C. *	Electrical Conductivity at 20°C. †
12	178	14000	22000	2	20000	0.000013	.3	35
112	178	14000	22000	2	20000	0.000013	. .	30
43	166	9000	19000	4	15000	0.000012	. .	35
47 modified	166	11000	26000	8	18000	0.000011	.3	35
122	178	21000	26000	½	25000	0.000012	.3	35
145	176	22000	29000	4	22000	0.000014	.3	. .
195-4	174	16000**	31000	8	27000	0.000013	. .	. .
195-10	174	27000	40000	2	30000	0.000013	. .	. .
195-16	174	22000	36000	4	29000	0.000013	. .	. .

*Values given are approximate. (Calories per cm. cube per sec. per degree C.)
†Volume Conductivity in per cent based on 100 for copper. (Annealed Copper Std.)
**See Table 3.
††For specification values consult nearest sales office of the Company.

TABLE 33

TYPICAL PROPERTIES OF VARIOUS COMMON MATERIALS

MATERIAL	Weight lb. per cu. ft.	Tensile Strength lb. per sq. in.	Yield Point lb. per sq. in.	Elongation in 2 inches per cent	Shear Strength lb. per sq. in.	Modulus of Elasticity lb. per sq. in.	Poisson's Ratio	Coef. of Expansion per degree F. 68°-212°F.	Specific Heat calories per gram	Thermal Conductivity* 100°C.	Electrical Conductivity** 20°C.
ALUMINUM ALLOYS	See Preceding Tables for Values Not Given					10,000,000	0.36		0.23		
BRASS Yellow Cast	524	40,000	20,000	15	36,000	10,000,000	0.33	0.000011	0.086	0.20	25
BRASS Yellow Hard Rolled	524	70,000	45,000	30	36,000	13,000,000	0.33	0.000011	0.086	0.20	25
BRONZE Phosphor Cast	567	30,000	15,000	10		12,000,000	0.33	0.000009	0.086	0.18	23
BRONZE Phosphor Wrought	567	50,000	25,000	25		12,000,000	0.33	0.000009	0.086		23
COPPER Commercial Cast	550	25,000	10,000	20	30,000	12,000,000	0.33	0.0000093	0.101	0.92	
COPPER Commercial Hard Rolled	550	50,000	25,000	10		17,000,000	0.33	0.0000093	0.101	0.92	97
IRON Common Cast	450	17,000	6,000		18,000	12,000,000	0.25	0.0000060	0.115	0.10	
IRON Wrought	480	48,000	26,000	35	45,000	28,000,000	0.28	0.0000063	0.115	0.14	17
LEAD Commercial Cast	706	1,800				1,000,000	0.44	0.000013	0.034	0.08	8
LEAD Commercial Rolled	706	3,000				1,000,000	0.44	0.000016	0.034	0.08	8
MONEL METAL Cast	550	70,000	35,000	25		25,000,000	0.30	0.0000078	0.128	0.06	4
MONEL METAL Hard Rolled	550	95,000	75,000	25	60,000	25,000,000	0.30	0.0000078	0.128	0.06	4
STEEL Cast	490	65,000	30,000	22	48,000	29,000,000	0.28	0.000007	0.118	0.12	15
STEEL Structural Rolled	490	65,000	35,000	25	48,000	29,000,000	0.28	0.000007	0.118	0.12	15
STEEL Nickel Rolled	490	95,000	55,000	16	72,000	29,000,000	0.28			0.12	
WOOD Oak	45	8,000			1,300	1,300,000		0.0000027	0.33	0.00035	
WOOD Spruce	27	5,500			780	1,200,000		0.0000030	0.33	0.00030	
WOOD Yellow Pine	27	5,000			700	1,000,000		0.0000030	0.33	0.00030	
ZINC Cast	443	5,500	5,000			11,000,000		0.000011	0.092	0.27	30
ZINC Rolled	443	23,000	9,000	33	19,000	12,000,000		0.000016	0.092	0.27	30

*Calories per cm. cube per sec. per degree C.

**Volume Conductivity in per cent based on 100 for copper. (Annealed Copper Std.)

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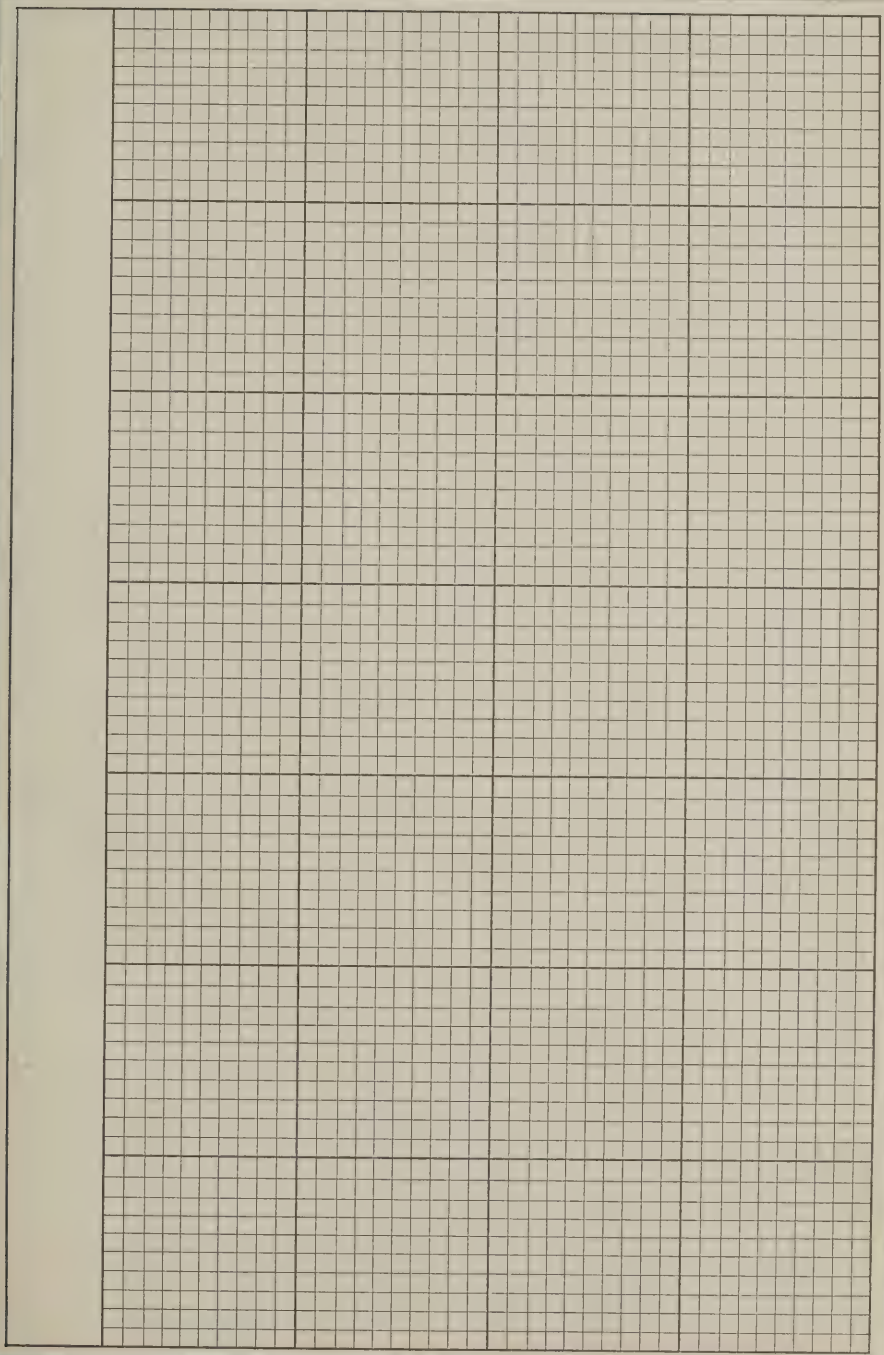
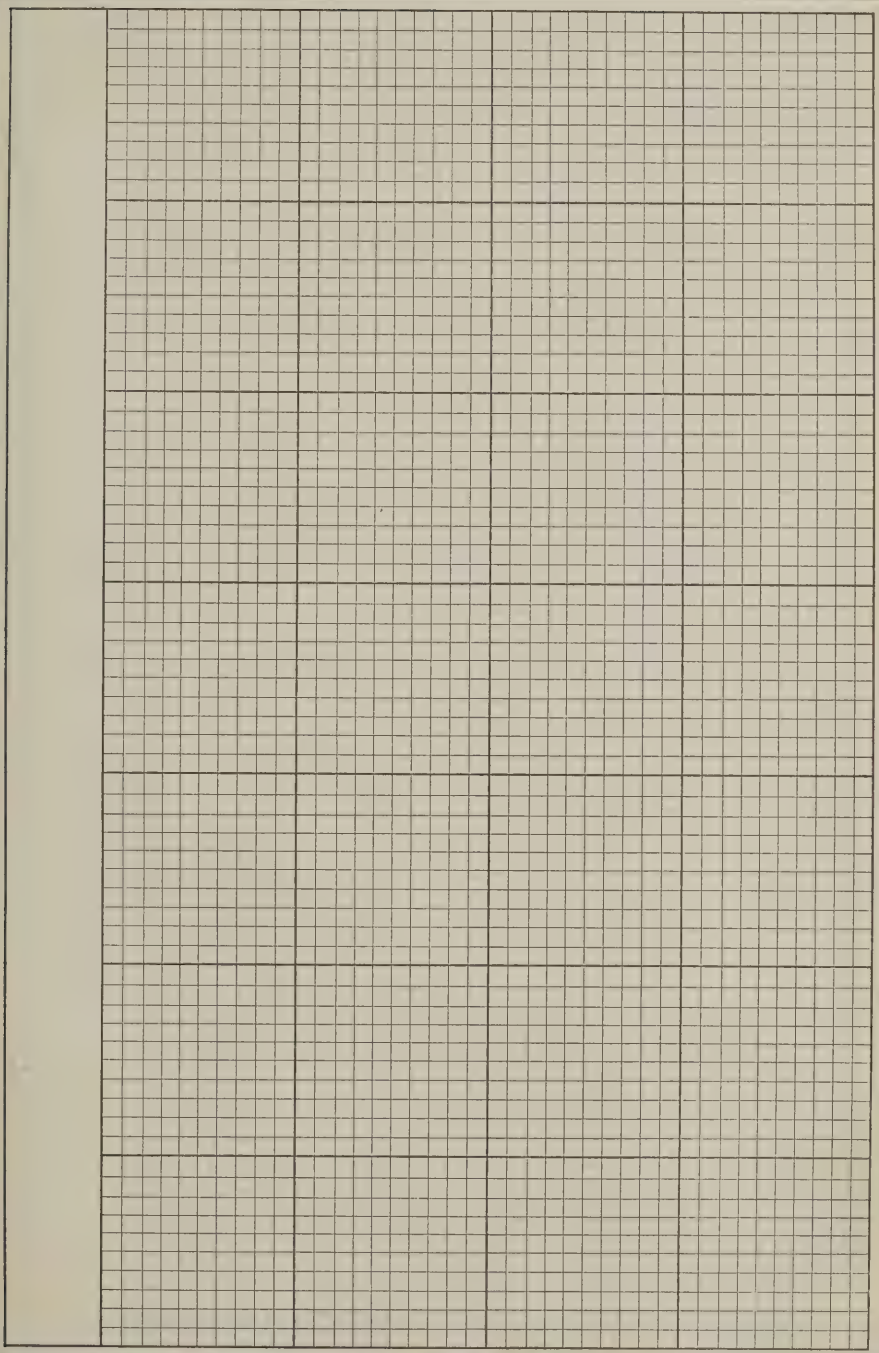
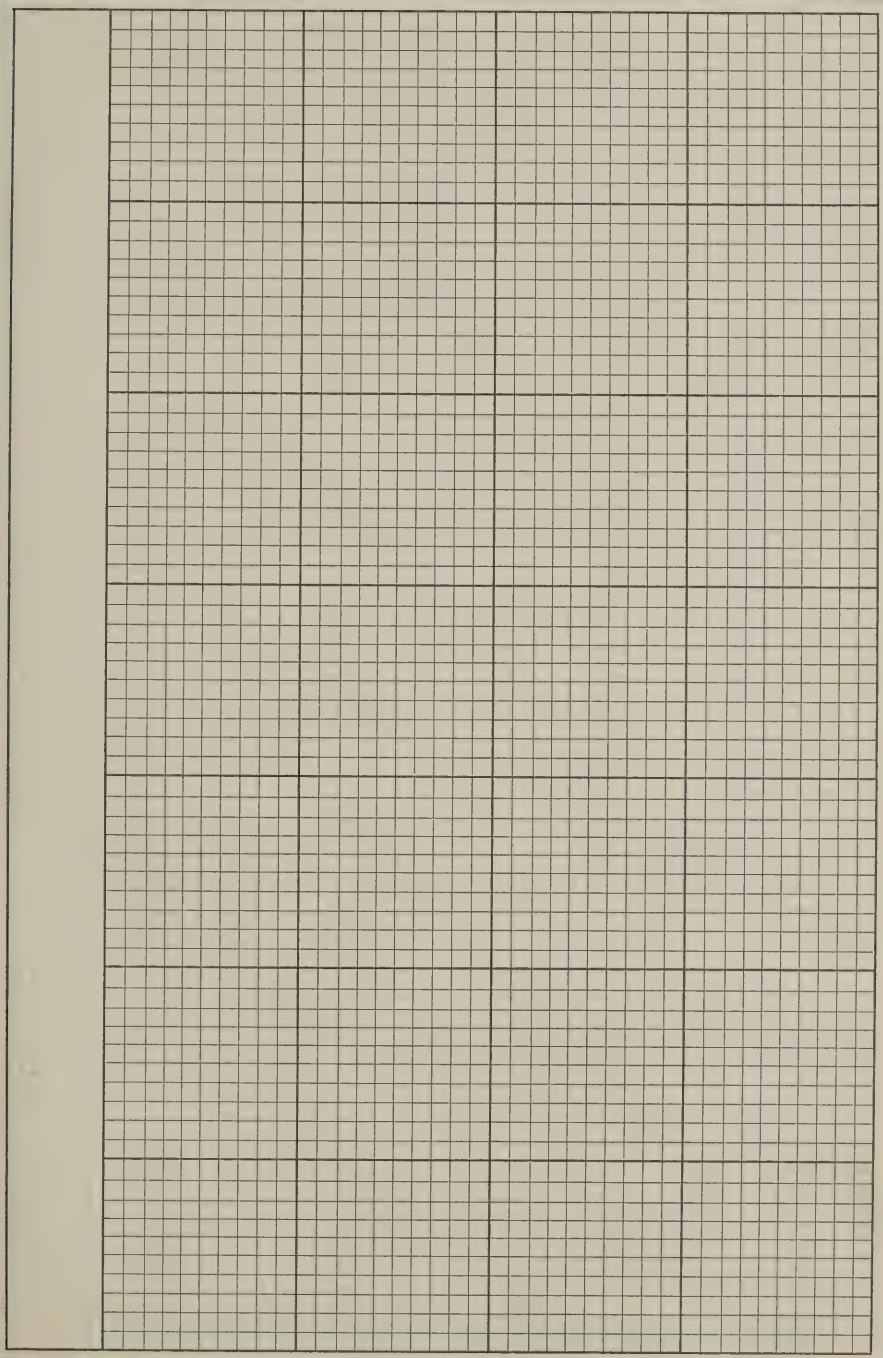
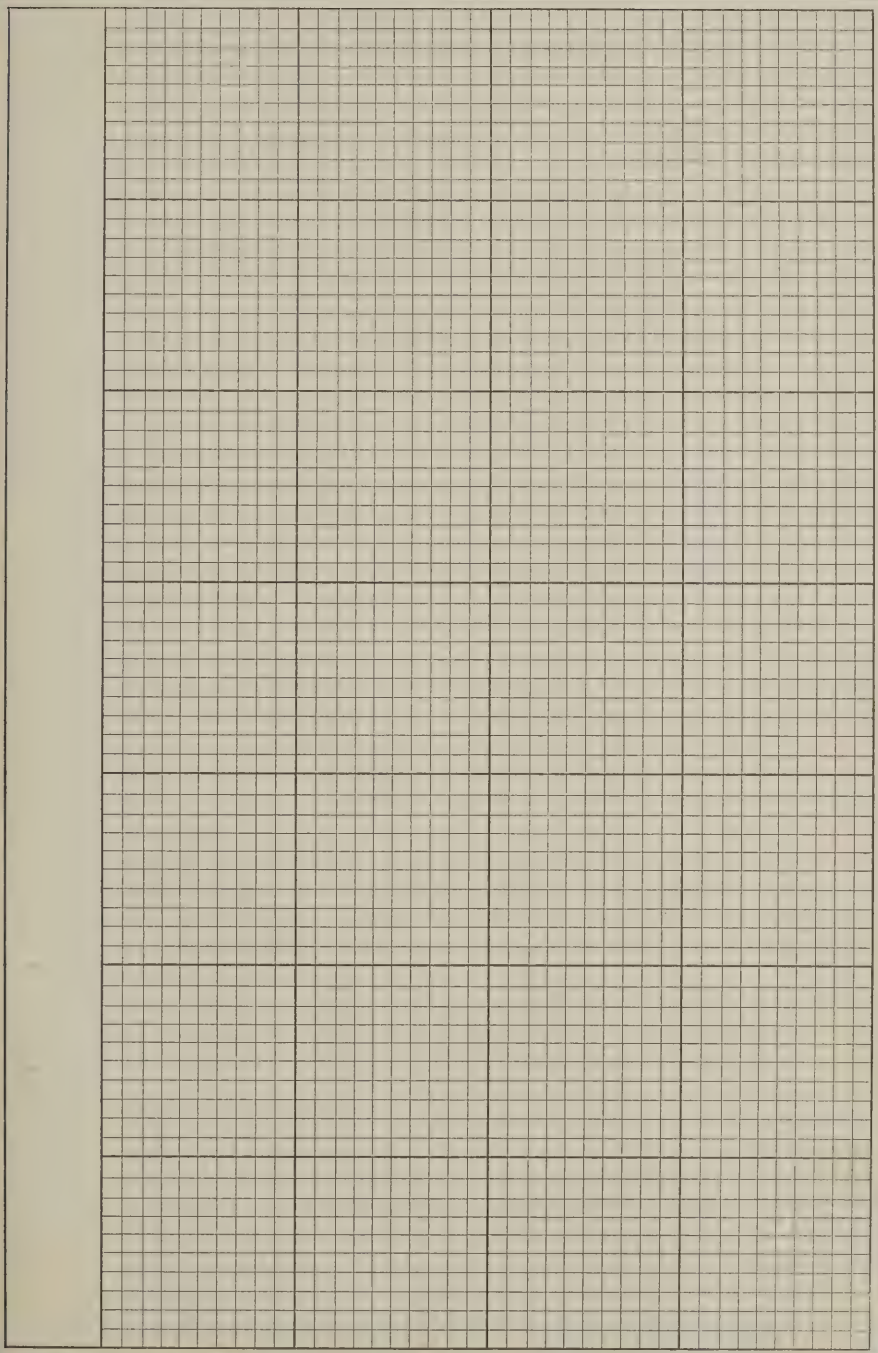
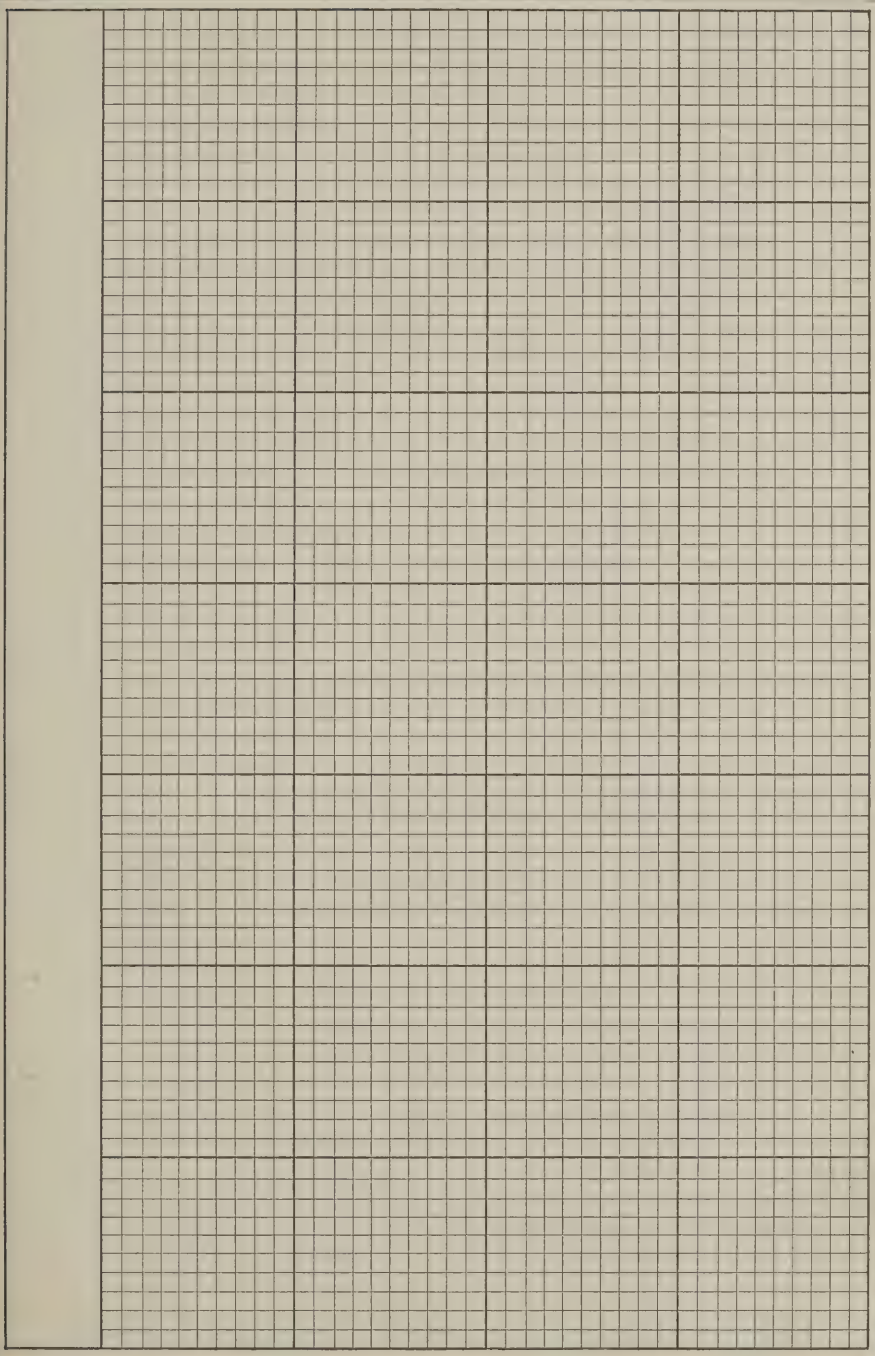
RULED SHEETS FOR NOTES AND DIAGRAMS

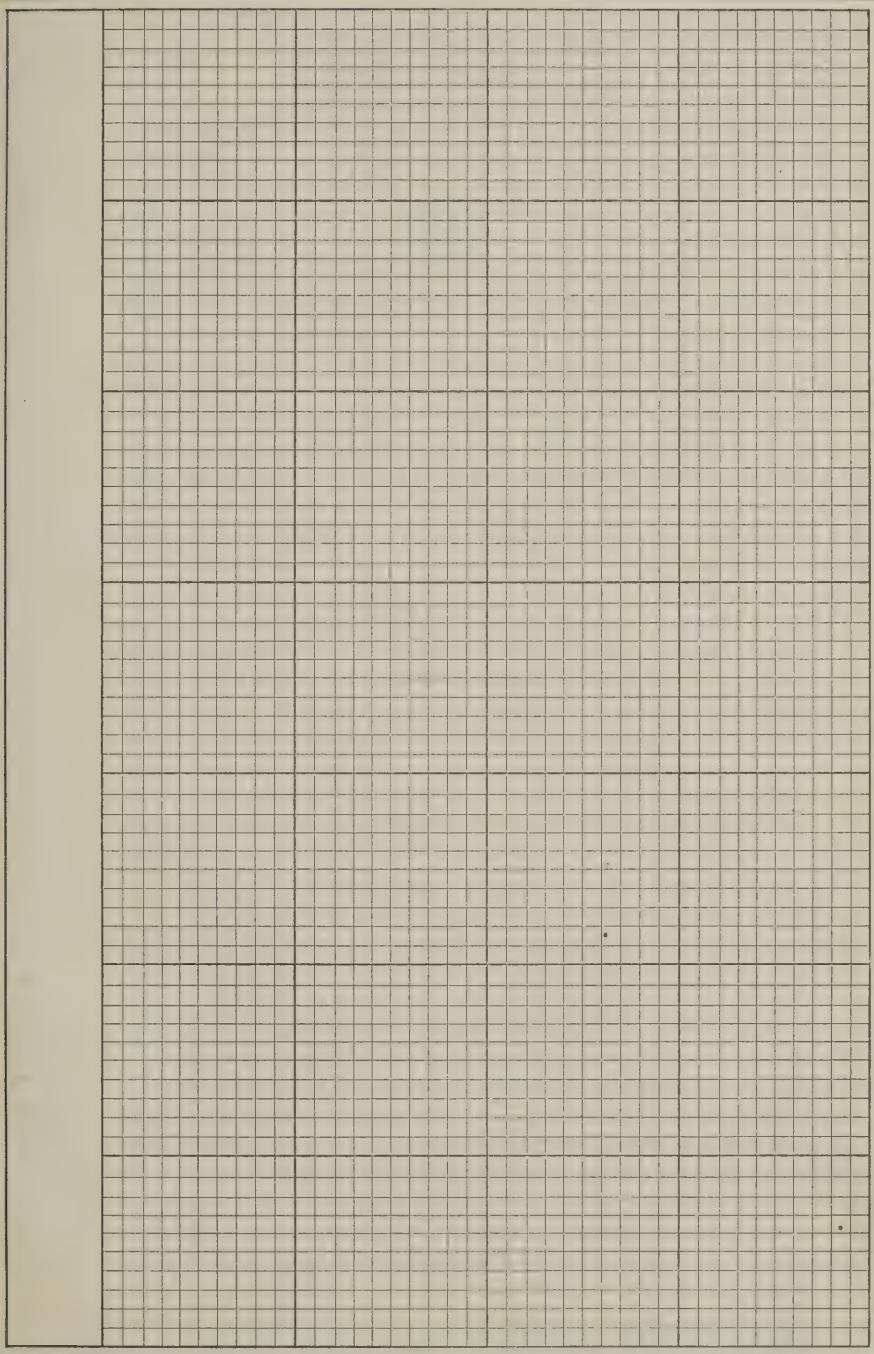












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ALUMINUM COMPANY OF AMERICA
PITTSBURGH, PENNSYLVANIA

1932

SUPPLEMENT
TO THE STRUCTURAL ALUMINUM HANDBOOK

CORRECTIONS

ATTENTION is called to the following typographical errors occurring in the 1930 edition of the Handbook and to the corrections thereof:

On Page 55 the value "b" for a 12-inch channel having a web thickness 0.632 inch should be 3.292 instead of 32.92.

In Table 19 in the dimensions of the hexagonal nut for a $\frac{5}{8}$ inch bolt the value "a" should be 1 inch instead of $\frac{15}{16}$ inch and the value of "b" should be 1.15 instead of 1.08.

A misprint occurs in Table 27 in the third column from the right. The third figure from the top should be $\frac{21}{32}$ instead of $\frac{21}{64}$.

The value of Poisson's ratio for aluminum alloys in Table 33 should be changed from 0.36 to 0.33.

In the paragraph "Punching and Drilling Rivet Holes" Page 33, third line from the end, change "one-fourth" to read "one-eighth".

SUPPLEMENTARY DATA

The majority of the following tables supplement various tables in the 1930 edition of the Handbook. The remainder are entirely new and will be found useful.

STRUCTURAL USE OF ADDITIONAL ALLOYS

4S ALLOY

4S has mechanical properties intermediate between those of 3S and the heat-treated alloys 17S, 25S and 51S. In its softer tempers it combines distinctly higher tensile and

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yield strengths than those of 3S, with considerable ductility. In the harder tempers the yield strength is comparable with that of the heat-treated alloys although the ultimate strength is lower and the amount of forming which can be done is limited. Its uses are similar to those of 3S alloy but is preferred to that alloy in cases where the higher properties are desirable.

A17S ALLOY

A17S is an alloy similar to 17S but containing smaller percentages of alloying hardeners. It has lower tensile and yield strengths than 17S but can be subjected to more severe forming operations. It may be used for rivets and for other applications in which the greater workability is required.

STANDARD STOCK

Our nearest sales office will supply an up-to-date list of structural stock items upon request.

SUPPLEMENT TO TABLE 1, PAGE 11

APPROXIMATE COMPOSITION
OF ALUMINUM ALLOYS

Alloy	Per cent of other elements added to aluminum			
	Copper	Manganese	Magnesium	Silicon
4S	....	1.25	1.00	....
A17S	2.50	....	0.30	....

SUPPLEMENT TO TABLE 2, PAGE 12

DATA ON HEAT-TREATMENT OF A17S

Alloy	Solution Heat-Treatment			Precipitation Heat-Treatment	
	Tempera-ture	Approximate Time of Heating*	Quench	Tempera-ture	Time of Aging
A17S	930°-950°F.	10-60 min.	Cold Water	Room	4 days†

*Depends on size and amount of material.
†More than 90 per cent of the maximum properties are obtained during the first day of aging.

SUPPLEMENT TO TABLE 3, PAGE 14

TYPICAL MECHANICAL PROPERTIES OF ALUMINUM ALLOYS

4S and A17ST

Alloy and Temper	Weight lb. per cu. ft.	TENSION			COMPRESSION		Shearing Strength lb. per sq. in.	Endurance† Limit lb. per sq. in. (Rotating Beam)	Brinell Hardness No. (500 kg. on 10mm. ball)
		Yield Point lb. per sq. in.	Ultimate Strength lb. per sq. in.	Elongation* in 2 In. per cent	Yield Point lb. per sq. in.	Ultimate Strength lb. per sq. in.			
4SO	170	10000	26000	20	10000	26000	16000	14000	45
4S¼H	170	25000	31000	10	25000	31000	17000	14500	55
4S½H	170	31000	35000	8	31000	35000	19000	15000	65
4SH	170	38000	42000	5	38000	42000	22000	16000	80
A17ST	172	22000	40000	22	22000	40000	25000	13500	70

*The elongation values based on data obtained from standard ½-inch diameter test specimen. Values for sheet and other sections using flat test specimens will be lower. For specification values consult nearest sales office of the Company.
†Based on the material withstanding 500 million cycles of stress.

SUPPLEMENT TO TABLE 4, PAGE 17

DESIGN STRESSES FOR ALUMINUM ALLOYS

4S and A17ST

Values below are considered safe for ordinary structural design. When temperatures above 100°F. are to be encountered, multiply these values by factors in Table 5.

Alloy and Temper	Tension lb. per sq. in.	Compression* lb. per sq. in.	Bearing lb. per sq. in.	Shear lb. per sq. in.	Fatigue lb. per sq. in.
4SO	6000	6000	6000	4000	14000
4S¼H	9000	9000	10000	4500	14500
4S½H	10000	10000	12000	5000	15000
4SH	13000	13000	15000	6000	16000
A17ST	10000	10000	13000	6000	13500

*Short stiff members.

THE FOLLOWING REPLACES TABLE 5, PAGE 17

FACTORS FOR DESIGN STRESSES
AT ELEVATED TEMPERATURES

	Alloy and Temper	100°F.	200°F.	300°F.	400°F.	500°F.
Wrought	3SO	1.0	0.85	0.70	0.60	0.40
	3S½H	1.0	0.75	0.60	0.45	0.30
	3SH	1.0	0.75	0.60	0.35	0.25
	4SO	1.0	0.90	0.80	0.50	0.40
	4S½H	1.0	0.90	0.65	0.30	0.25
	4SH	1.0	0.80	0.55	0.25	0.20
	17ST	1.0	0.90	0.60	0.30	0.15
	A17ST	1.0	0.90	0.60	0.30	0.15
	25SW	1.0	1.00	0.75	0.30	0.15
	25ST	1.0	0.90	0.60	0.25	0.10
	51SW	1.0	1.00	0.80	0.30	0.15
	51ST	1.0	0.75	0.55	0.20	0.10

NOTE: The above table, based on more extensive test data, supersedes Table 5 as published in the 1930 edition of the Handbook.

SUPPLEMENT TO TABLE 6, PAGE 19

VALUES FOR COLUMN FORMULAS

4S and A17ST

Alloy and Temper	Round-Ends			Fixed-Ends		
	C	B	K	C	B	K
4SO	128	6000	31	256	6000	15.5
4S½H	100	10000	67	200	10000	33.5
4SH	87	13000	100	174	13000	50.0
A17ST	100	10000	67	200	10000	33.5

SUPPLEMENT TO TABLE 9, PAGE 31

APPROXIMATE RADII FOR 90° COLD BENDS

4S and A17ST

Alloy and Temper	Bend radii for different thicknesses of sheet		
	1/16 inch Sheet	1/8 inch Sheet	1/4 inch Sheet
4SO	0	0	0
4S¼H	t	2t	3t
4S½H	2t	3t	5t
4SH	4t	..	..
A17ST	t	2t	4t

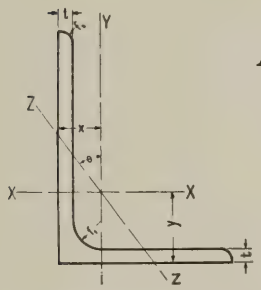
FACTORS SUPPLEMENTING VALUES ON PAGE 41

For 4S multiply by 0.977
For A17S multiply by 0.989
For 43S multiply by 0.954

STRUCTURAL SHAPES

TOLERANCE

Aluminum structural shapes in which the thickness of flange, web, or leg is not less than 0.140 inch are fabricated to meet a tolerance on weight of plus or minus two and one-half per cent. The actual weight shipped is invoiced, consequently estimates should take into consideration the possibility of the maximum plus tolerance.



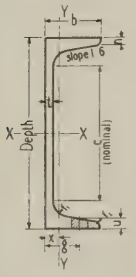
ANGLES

ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I = Moment of Inertia in in.^{4}
S = Section Modulus in in.^{3}
r = Radius of Gyration in inches.

SUPPLEMENT TO TABLES BEGINNING ON PAGE 42

Size	Legs	1 X 1	1¼ X 1¼	1½ X 1½	3 X 3
	t	3/32	3/32	3/32	3/16
	Wt.	0.22	0.28	0.33	1.33
	Area	0.18	0.23	0.28	1.10
	f_1	1/8	3/16	3/16	5/16
	f_2	3/32	1/8	1/8	1/4
Axis X-X	I	0.016	0.033	0.058	0.93
	S	0.022	0.036	0.053	0.42
	r	0.30	0.38	0.46	0.92
	y	0.28	0.34	0.40	0.80
Axis Y-Y	I	0.016	0.033	0.058	0.93
	S	0.022	0.036	0.053	0.42
	r	0.30	0.38	0.46	0.92
	x	0.28	0.34	0.40	0.80
Axis Z-Z	Θ	45° 0′	45° 0′	45° 0′	45° 0′
	I	0.007	0.014	0.024	0.38
	r	0.19	0.24	0.30	0.59



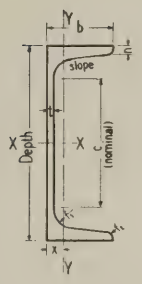
CHANNELS

ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I =Moment of Inertia in in.^{4}
S =Section Modulus in in.^{3}
r =Radius of Gyration in inches.
Rivet given is maximum allowable in flange.
g =Usual gage.
u =Nominal grip.

SUPPLEMENT TO TABLES BEGINNING ON PAGE 54

Size	Depth	6	7	8
	t	0.225	0.230	0.250
	b	1.945	2.110	2.290
	Wt.	3.09	3.64	4.38
	Area	2.55	3.01	3.62
	n	0.20	0.21	0.22
	f_1	0.30	0.31	0.32
	f_2	0.12	0.13	0.13
	c	$4\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{2}$
Axis X-X	I	13.57	21.84	33.85
	S	4.52	6.24	8.46
	r	2.31	2.69	3.06
Axis Y-Y	I	0.73	1.01	1.40
	S	0.51	0.64	0.81
	r	0.54	0.58	0.62
	x	0.51	0.54	0.56
Rivet Data	Diam.	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{3}{4}$
	g	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$
	u	$\frac{5}{16}$	$\frac{7}{16}$	$\frac{3}{8}$



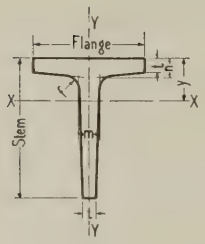
CAR CHANNELS

ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I = Moment of Inertia in in.^{4}
S = Section Modulus in in.^{3}
r = Radius of Gyration in inches.

SUPPLEMENT TO TABLE ON PAGE 56

Size	Depth	3	4	6	7	8
	t	0.250	0.318	0.375	0.360	0.380
	b	2.00	2.50	3.50	3.00	3.00
	Wt.	2.61	3.41	6.34	6.41	7.13
	Area	2.15	2.82	5.24	5.29	5.89
	Slope	1:12	1:35	1:50	1:18	1:18
	n	0.250	0.313	0.413	0.360	0.380
	f_1	0.25	0.38	0.48	0.55	0.55
	f_2	.....	0.13	0.42	0.20	0.20
	c	1.71	2.50	4.10	4.89	5 85
Axis X-X	I	3.15	6.84	29.94	40.35	57.02
	S	2.10	3.42	9.98	11.53	14.26
	r	1.21	1.56	2.39	2.76	3.11
Axis Y-Y	I	0.69	1.62	5.60	3.79	4.12
	S	0.53	0.95	2.34	1.78	1.90
	r	0.57	0.76	1.03	0.85	0 84
	x	0.70	0.81	1.10	0.87	0 83



TEES

ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I = Moment of Inertia in in.^{4}
S = Section Modulus in in.^{3}
r = Radius of Gyration in inches.

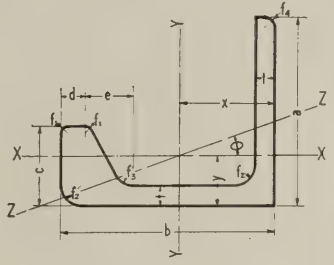
SUPPLEMENT TO TABLES ON PAGE 58

Size				
Size	Flange	1½	2¼	4
	Stem	1½	2¼	2
t		3/16	1/4	3/8
Wt.		0.70	1.47	2.78
Area		0.58	1.21	2.30
m		7/32	5/16	7/16
n		7/32	5/16	7/16
f		3/16	1/4	1/4
Axis X-X	I	0.11	0.53	0.60
	S	0.11	0.33	0.40
	r	0.44	0.66	0.51
	y	0.44	0.64	0.48
Axis Y-Y	I	0.06	0.26	2.10
	S	0.08	0.23	1.05
	r	0.31	0.46	0.96

CAR BUILDING BULB ANGLE

ELEMENTS OF SECTIONS

All Dimensions in inches.
Weight in pounds per foot.
Area in square inches.
I = Moment of Inertia in in.^{4}
S = Section Modulus in in.^{3}
r = Radius of Gyration in inches.



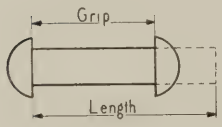
Size	Legs	4 x 3½
	t	⅜
	a	4.00
	b	3.50
	c	1.50
	d	7/16
	e	13/16
	Wt.	4.32
	Area	3.57
	f_1	⅛
	f_2	⅜
	f_3	¼
	f_4	3/16
Axis X-X	I	3.02
	S	1.18
	r	0.92
	y	0.93
Axis Y-Y	I	7.95
	S	3.58
	r	1.49
	x	1.78
Axis Z-Z	Θ	20° 13′
	I	2.25
	r	0.79

TABLE 15A

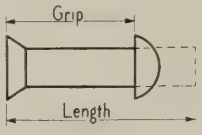
SUPPLEMENT TO DATA ON PAGE 88

LENGTHS OF RIVETS FOR VARIOUS GRIPS

For Hole Diameter 1/32 inch Greater than Rivet Diameter



Case 1



Case 2

Grip	Diameter of Rivet								
	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1
1/8	9/16	5/8	3/4	....	....	....	....	....	.
1/4	3/4	13/16	7/8	15/16	1 1/16	1 5/16	1 9/16	....	....
3/8	15/16	1	1 1/8	1 3/16	1 1/4	1 1/2	1 11/16	1 7/8	2 1/8
1/2	1 1/8	1 3/16	1 1/4	1 5/16	1 7/16	1 11/16	1 13/16	2	2 1/4
5/8	1 1/4	1 5/16	1 3/8	1 7/16	1 9/16	1 13/16	2	2 3/16	2 3/8
3/4	1 7/16	1 1/2	1 9/16	1 5/8	1 11/16	1 15/16	2 3/16	2 5/16	2 1/2
7/8	1 5/8	1 11/16	1 3/4	1 13/16	1 7/8	2 1/16	2 5/16	2 1/2	2 5/8
1	1 13/16	1 13/16	1 7/8	1 15/16	2	2 1/4	2 7/16	2 5/8	2 3/4
1 1/8	....	2	2 1/16	2 1/8	2 3/16	2 3/8	2 5/8	2 3/4	2 15/16
1 1/4	....	2 3/16	2 3/16	2 1/4	2 5/16	2 9/16	2 3/4	2 15/16	3 1/8
1 3/8	....	....	2 3/8	2 7/16	2 1/2	2 11/16	2 7/8	3 1/16	3 5/16
1 1/2	....	....	2 9/16	2 9/16	2 5/8	2 7/8	3 1/16	3 3/16	3 7/16
1 5/8	....	....	....	2 3/4	2 3/4	3	3 3/16	3 3/8	3 9/16
1 3/4	....	....	....	2 15/16	2 15/16	3 1/8	3 3/8	3 1/2	3 3/4
1 7/8	....	....	....	....	3 1/8	3 5/16	3 1/2	3 11/16	3 7/8
2	....	....	....	....	3 5/16	3 7/16	3 11/16	3 13/16	4 1/16
2 1/8	....	....	....	....	....	3 5/8	3 13/16	3 15/16	4 3/16
2 1/4	....	....	....	....	....	3 3/4	4	4 1/8	4 5/16
2 3/8	....	....	....	....	....	3 15/16	4 1/8	4 1/4	4 1/2
2 1/2	....	....	....	....	....	4 1/16	4 1/4	4 7/16	4 5/8

Values above heavy line apply to Case 1 only.
These lengths are for a hole diameter 1/32 inch larger than the rivet diameter, which gives the best results, and are satisfactory for ordinary shop practice using 17S alloy rivets and plates. Because of variations in rivet sets and driving conditions, however, it is well to check these lengths by actual driving tests before specifying the exact length of rivets.
The rivets upon which these values are based are the types described on Page 88 of the 1930 edition of the Handbook.

TABLE 15B

SUPPLEMENT TO DATA ON PAGE 88

LENGTHS OF RIVETS FOR VARIOUS GRIPS

For Hole Diameter 1/16 inch Greater than Rivet Diameter

Grip	Diameter of Rivet				
	1/2	5/8	3/4	7/8	1
1/4	1 1/8	1 3/8	1 5/8	...	...
3/8	1 3/8	1 5/8	1 3/4	2	2 1/8
1/2	1 1/2	1 3/4	1 7/8	2 1/8	2 1/4
5/8	1 5/8	1 7/8	2 1/8	2 1/4	2 3/8
3/4	1 3/4	2	2 1/4	2 3/8	2 5/8
7/8	2	2 1/8	2 3/8	2 5/8	2 3/4
1	2 1/8	2 3/8	2 1/2	2 3/4	2 7/8
1 1/8	2 3/8	2 1/2	2 3/4	2 7/8	3 1/8
1 1/4	2 1/2	2 3/4	2 7/8	3	3 1/4
1 3/8	2 3/4	2 7/8	3	3 1/8	3 3/8
1 1/2	2 7/8	3	3 1/4	3 1/4	3 1/2
1 5/8	3	3 1/8	3 3/8	3 1/2	3 5/8
1 3/4	3 1/4	3 3/8	3 1/2	3 5/8	3 7/8
1 7/8	3 3/8	3 1/2	3 5/8	3 7/8	4
2	3 5/8	3 5/8	3 7/8	4	4 1/4
2 1/8	...	3 7/8	4	4 1/8	4 3/8
2 1/4	...	4	4 1/4	4 1/4	4 1/2
2 3/8	...	4 1/4	4 3/8	4 3/8	4 5/8
2 1/2	...	4 3/8	4 1/2	4 5/8	4 3/4

Values in this table for hole 1/16 inch larger than rivet diameter, and for type of rivet described on Page 88 of the 1930 edition of the Handbook.

TABLE 24A

SAFE UNIFORMLY DISTRIBUTED LOAD ON 2½-INCH CORRUGATED SHEET

NOTE: Table 24, page 97 is for 3S¾H. Table 24A is for 4S¾H.

Gage B & S	Thickness Inches	Safe Loads for Various Span Lengths, Pounds per Sq. Ft.								
		24 In.	30 In.	36 In.	42 In.	48 In.	54 In.	60 In.	66 In.	72 In.
14	.064	346	222	154	113	86	68	55	46	38
16	.051	276	177	123	90	69	55	44	36	31
18	.040	217	139	96	71	54	43	35	28	24
20	.032	173	111	77	56	43	34	28	23	19
22	.025	135	87	60	44	34	27	22	18	15

TABLE 31A

SUPPLEMENT TO TABLE 31, PAGE 103

TYPICAL PROPERTIES OF WROUGHT ALUMINUM ALLOYS

Alloy and Temper	Weight lb. per cu. ft.	Yield Point lb. per sq. in.	Tensile Strength lb. per sq. in.	††Elongation in 2 in. per cent	Shearing Strength lb. per sq. in.	Coef. of Expansion per Degree F. 68°-212°F.	Approximate Thermal Conductivity at 100°C.*	Approximate Electrical Conductivity at 20°C.†
4SO	170	10000	26000	20	16000	0.000013	0.45	50
4S¼H	170	25000	31000	10	17000	0.000013	....	..
4S½H	170	31000	35000	8	19000	0.000013	....	..
4SH	170	38000	42000	5	22000	0.000013	0.35	40
A17ST	172	22000	40000	22	25000	0.000012	....	..
43SO	166	6000	17000	35	12000	0.000012	....	..
43S½H	166	21000	23000	15	15000	0.000012	....	..
43SH	166	28000	30000	8	17000	0.000012	0.45	50

*Calories per cm. cube per sec. per degree C.
†Volume conductivity in per cent based on 100 for copper. (Annealed copper Std.)
††The elongation values based on data obtained from standard ½-inch diameter test specimen. Values for sheet and other sections using flat test specimens will be lower. For specification values consult nearest sales office of the Company.

TABLE 34

Weights of DIAMONDETTE FLOOR PLATE

Manufactured by

ALAN WOOD STEEL COMPANY

Conshohocken, Pa.

Gage	Approximate Weight lb. per sq. ft.		
	17S and 25S	3S	Steel
7/64	1.94	1.89	5.50
1/8	2.16	2.11	6.13
3/16	3.04	2.97	8.63
1/4	3.92	3.83	11.13
5/16	4.80	4.69	13.63
3/8	5.68	5.55	16.13

Weights of "KNOBBY NON-SKID" FLOOR PLATE

Manufactured by

CENTRAL IRON & STEEL COMPANY

Harrisburg, Pa.

Gage	Approximate Weight lb. per sq. ft.		
	17S and 25S	3S	Steel
5/64	1.23	1.20	3.50
7/64	1.94	1.89	5.50
1/8	2.73	2.66	7.75
3/16	3.09	3.00	8.75
1/4	3.96	3.89	11.25
5/16	4.84	4.71	13.75
3/8	5.71	5.59	16.25

TABLE 35

COMPARATIVE WEIGHTS OF STEEL AND ALUMINUM SHEET

Aluminum Weights are for 3S and 4S.
Multiply by 1.02 for weight of 17S and 25S

Decimal Thickness	B & S Gage	Weight in Lb. per Sq. Ft.		U. S. Gage	Fraction Thickness
		Aluminum	Steel		
.460	4–0	6.48	.....	...	..
.438	...	6.17	17.91	5–0	7/16
.410	3–0	5.77	.....	...	..
.406	...	5.72	16.60	4–0	13/32
.375	...	5.28	15.33	3–0	3/8
.365	2–0	5.14	.....	...	..
.344	...	4.85	14.06	2–0	11/32
.325	0	4.58	.....	...	..
.313	...	4.41	12.80	0	5/16
.289	1	4.08	.....	...	..
.281	...	3.96	11.49	1	9/32
.266	...	3.75	10.87	2	17/64
.258	2	3.63	.....	...	..
.250	...	3.52	10.22	3	1/4
.234	...	3.30	9.57	4	15/64
.229	3	3.23	.....	...	..
.219	...	3.08	8.95	5	7/32
.204	4	2.88	.....	...	..
.203	...	2.86	8.30	6	13/64
.188	...	2.65	7.69	7	3/16
.182	5	2.56	.....	...	..
.172	...	2.42	7.03	8	11/64
.162	6	2.28	.....	...	..
.156	...	2.20	6.38	9	5/32
.144	7	2.03	.....	...	..
.141	...	1.99	5.76	10	9/64
.129	8	1.81	.....	...	..
.125	...	1.76	5.11	11	1/8
.114	9	1.61	.....	...	..
.109	...	1.54	4.46	12	7/64
.102	10	1.44	.....	...	..
.094	...	1.32	3.83	13	3/32
.091	11	1.28	.....	...	..
.081	12	1.14	.....	...	..
.078	...	1.10	3.19	14	5/64
.072	13	1.01	.....	...	..
.070	...	0.990	2.87	15	..
.064	14	0.903	.....	...	..
.063	...	0.880	2.55	16	1/16
.057	15	0.804	.....	...	..
.056	...	0.793	2.30	17	..
.051	16	0.716	.....	...	..
.050	...	0.704	2.04	18	.
.045	17	0.638	.....	...	.

TABLE 35—*Continued*

COMPARATIVE WEIGHTS OF STEEL AND ALUMINUM SHEET

Aluminum Weights are for 3S and 4S.
Multiply by 1.02 for weight of 17S and 25S

Decimal Thickness	B & S Gage	Weight in Lb. per Sq. Ft.		U. S. Gage	Fraction Thickness
		Aluminum	Steel		
.044	...	0.617	1.79	19	..
.040	18	0.568	....	...	..
.038	...	0.528	1.53	20	..
.036	19	0.506	....	...	..
.034	...	0.485	1.41	21	..
.032	20	0.450	....	...	..
.031	...	0.441	1.28	22	1/32
.0285	21	0.401	....	...	..
.0281	..	0.396	1.15	23	..
.0253	22	0.357	....	...	..
.0250	...	0.352	1.02	24	..
.0226	23	0.318	....	...	..
.0219	...	0.308	0.90	25	..
.0201	24	0.283	....	...	..
.0188	...	0.265	0.769	26	..
.0179	25	0.252	.....	...	..
.0172	...	0.242	0.703	27	..
.0159	26	0.225	.....	...	..
.0156	...	0.220	0.638	28	1/64
.0142	27	0.200	.....	...	..
.0141	...	0.199	0.576	29	..
.0126	28	0.178	.....	...	..
.0125	..	0.176	0.511	30	..
.0113	29	0.159	.....	...	..
.0100	30	0.141	....	...	..